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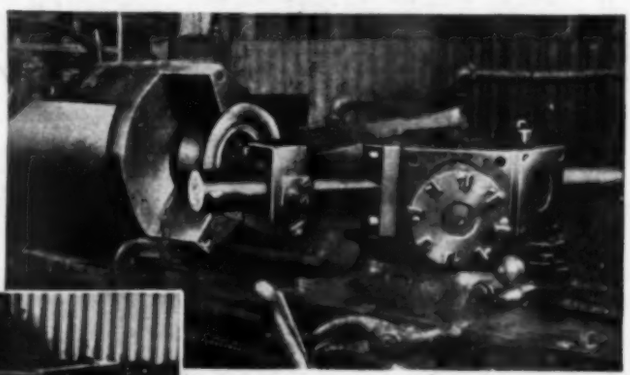
Production of Track Parts for Caterpillar Tractors

By Frank W. Curtis

TRACK ROLLERS for Caterpillar tractors are of composite assembly. They consist of cast-iron hubs on both ends of which forged rims of S.A.E. 1045 steel are assembled by shrinking. The completed rollers are mounted on each side of the tractor to keep the moving tracks in alignment.

Before the rims are machined they are normalized to remove any forging strains. Boring and facing is done in the turret lathe illustrated in Fig. 1, in which a 3-jaw, air-operated chuck is used to hold the work by the surface of its tread. Three tools are mounted on the turret faces: one for boring and facing; one for chamfering; and one for reaming. The holder used for the tools is of the double type and is mounted on a slide operated by hand. The diameter of the bore is 4.50 in. It is held to within plus or minus 0.002 inch.

The operation of turning the rims is handled in a special machine of the automatic type, as shown in Fig. 2. The work is held on an expanding mandrel having four, equally-spaced, serrated jaws operated by a tapered drawbar, pneumatically controlled. On the



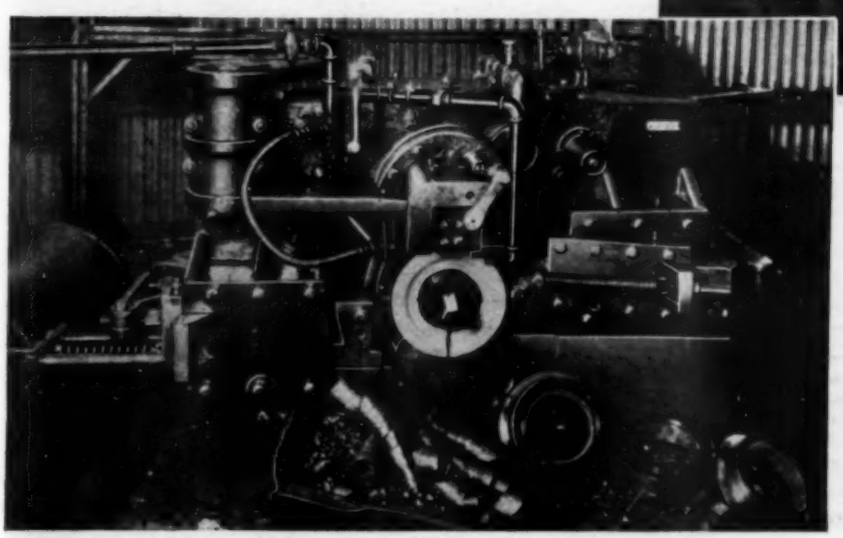


Fig. 1—After the rims have been normalized, they are bored and faced in a turret lathe equipped with a 3-jaw, air-operated chuck. The bores are roughed to within $\frac{1}{64}$ in. of size and are then reamed to the finish dimensions. The tolerance is 0.002 inch

Fig. 2—Rims are turned in an automatic machine equipped with roughing and finishing tools. The flanges and treads are finished at one setting, the work being flooded with coolant. An expanding-type mandrel holds the work by four serrated jaws

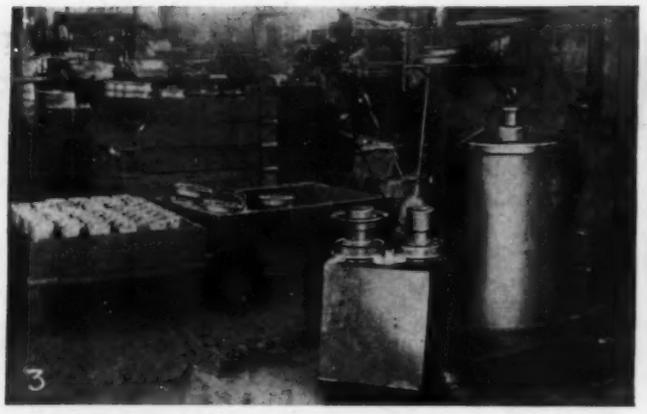


Fig. 3—For shrinking on the hubs, the rims are heated to from 1,460 to 1,480 deg. F. in a furnace of the rotary type.

Fig. 4—The hub is placed on a vertical plunger connected to an air cylinder. Pressing a button opens a valve, and the plunger drops below the surface of the quenching bath. It is raised automatically after exactly eight seconds

right-hand side of the machine is located the slide for the roughing tools, while on the left-hand side is a slide carrying a form tool for finishing. Both slides feed the tools directly into the face of the work to a predetermined depth. In operation, it is only necessary for the operator to place a rim on the mandrel, trip a lever that operates the drawbar, start the machine, and remove the work after it has been finished.

The equipment for shrinking and hardening is illustrated in Fig. 3. The rims are heated in a rotary furnace, being removed when they have reached a temperature of from 1,460 to 1,480 deg. F. In front of the furnace may be seen the tank in which the quenching for both the shrinking and the hardening is done. The plunger upon which the work is placed is operated in a vertical direction by an air cylinder, and at the elevated position shown, is easily accessible for loading. After a hub has been placed on the plunger, a heated rim is placed on the seat at the end, and the entire unit is quenched immediately. In Fig. 4 is a view looking directly into the tank. It shows a hub with a rim shrunk on its upper end. In assembling the other rim, the hub is reversed on the plunger. The second rim is then placed on the hub and quenched.

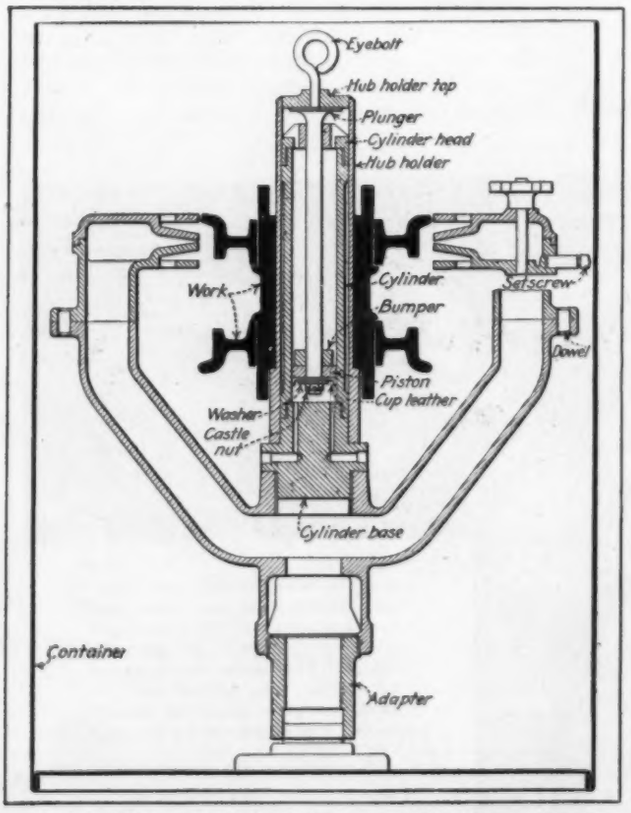


Fig. 5—The quenching fixture has a ring that surrounds the submerged work, through which water is forced under pressure to the tread of the rim. The time the work is allowed to remain in the quenching bath is limited by an automatic timing device

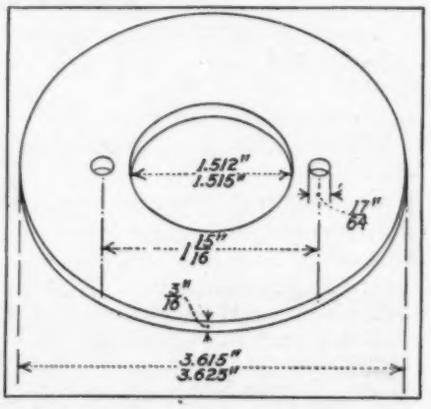


Fig. 6—Thrust washers for the track rollers of Caterpillar tractors have dowel-pin holes between the edges and the central holes

The combined operations of shrinking and quenching are automatically controlled by a device that limits the time the work remains in the quenching bath. With the work in place, the operator presses a button that operates the exhaust valve leading from the air cylinder. As the air is exhausted from the cylinder, the plunger descends, carrying the work below the surface of the bath. The work remains submerged 8 sec. Then an automatic, timing device opens a valve and admits air into the cylinder, bringing the plunger and work above the level of the bath. To insure a supply of cool water at the outer surface of the rim, when submerged, it is surrounded by a quenching ring through which water passes under pressure. The construction of the ring is shown in Fig. 5 with the work in the quenching position. Control of the water through the ring is automatic, and it is turned on only after the work is fully submerged in the bath. The rim seats on the hub are machined to a diameter of 4.510 in. ± 0.002 in., thus allowing approximately 0.010 in. for a shrink fit.

No drawing operation is required, since the 8-sec. duration of the quench controls the hardness of the rim. Results, as compared with other methods, show that the hubs of the rims do not harden as much as do the flanges and treads, and that cracks in the face of the work have been eliminated. A Brinell hardness of 2.7 is given to the outer surfaces of the work.

Thrust washers for the track-roller assemblies are made in seven sizes. Their designs are similar, although some have two dowel-pin holes drilled between the center hole and the outer edges as shown in Fig. 6, while others have slots milled at the outer edges instead.

Tooling for machining the washers is arranged for runs of large quantities, and is suited to the various sizes manufactured. The sequence of operations is as follows:

1. Drill and ream center hole to size
2. Burr both sides of the center hole
3. Drill two dowel-pin holes
4. Turn outside diameter to size
5. Mill locating slot.

Machines for these operations are set up facing each other, with the drill presses on one side, and the lathe and the milling machine on the opposite side. This arrangement enables the entire job to be run by one operator, two or three operations being grouped together, a quantity of washers being run through and then completed in the next group formation. While there is a slight amount of idle machine time, the production requirements are easily attained.

The set-up used for drilling and reaming the center holes is illustrated in Fig. 7. On the table of the machine is a base upon which is mounted a 3-jaw chuck, operated by compressed air. The jaws of the chuck are stepped and can accommodate several sizes of washers. When the spindle of the machine is lowered by operating the lever at the left, the action automatically opens the valve admitting air to the cylinder through a cam, a lever, and a connecting link attached to the machine, as shown. The mechanism is so timed that the air valve is opened, closing the chuck jaws before the cutter comes into contact with the work. A four-lipped drill and a helical reamer are mounted in tandem on the toolholder. The feed for these tools is automatic and is disengaged at the completion of the cut by a trip. At the same time, the spindle is brought back to the starting position through the action of a counterweight. The raising of the spindle causes the reverse action of the air valve, exhausting the air from the cylinder and releasing the chuck jaws from the work. The amount of stock removed in this operation varies from $\frac{1}{16}$ to $\frac{3}{32}$ in., according to the original diameter of the hole.

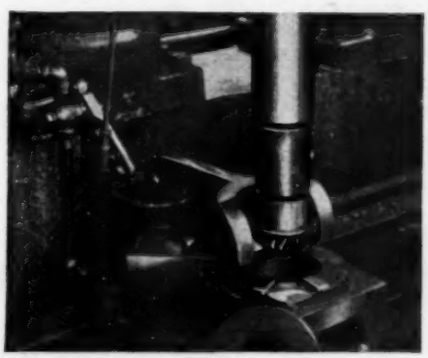


Fig. 8—After machining, the washers are burred on both sides. The clamp shown is automatically operated by compressed air. Moving the spindle up or down operates the valve connecting the cylinder to the air line

While the central hole of one washer is being drilled and reamed, a washer that has been previously machined is burred in the machine illustrated in Fig. 8. The fixture is operated by compressed air, and the clamping action is automatically synchronized with the movement of the spindle. When the operator lowers the spindle, the valve connecting the cylinder to the air line is opened by means of a connecting link, admitting air and causing the clamp

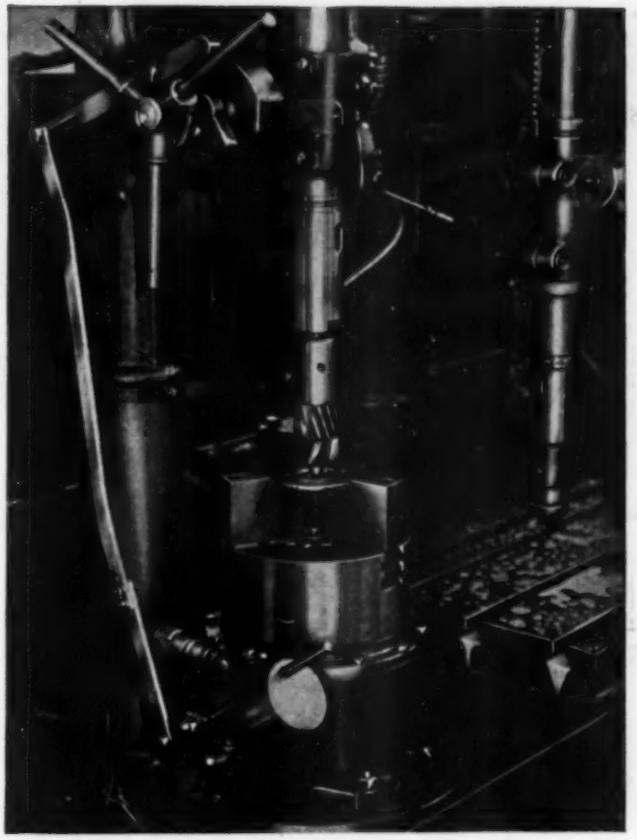


Fig. 7—A 3-jaw air chuck holds the washers while the central holes are being drilled and reamed. Operation of the chuck is controlled by the vertical movement of the spindle, and is arranged to grip the work before cutting action actually starts

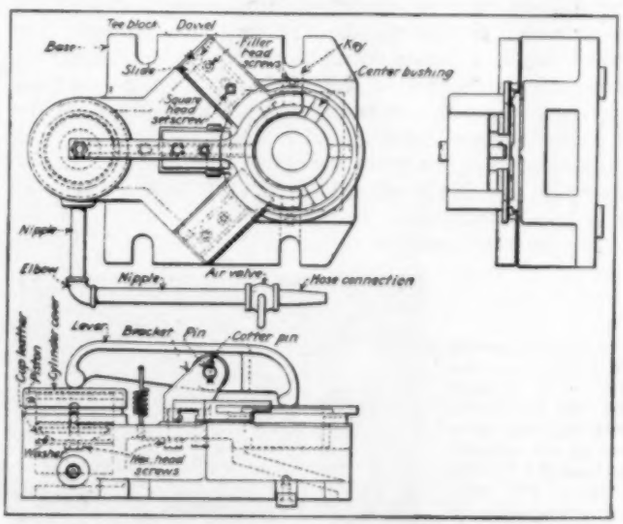


Fig. 9—The base casting of the jig for burring is an air cylinder of the single acting type. When air is admitted to the top of the cylinder, the plunger descends, actuating the pneumatic clamp

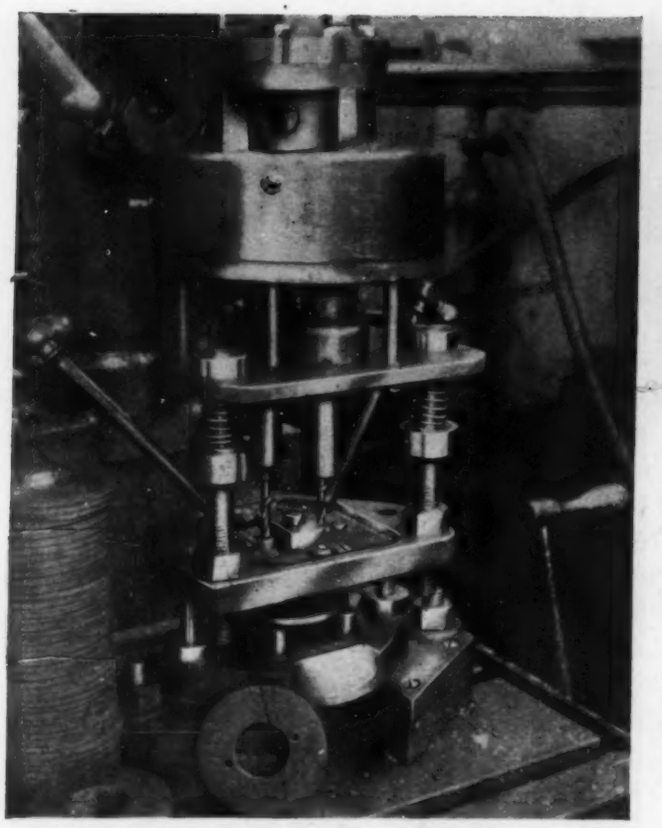


Fig. 10—Multiple-spindle drill head equipped with a bushing plate aligned with the jig by two leader pins. When the head is lowered, the bushing plate clamps the work

connected to the plunger to close upon the work. The clamp holds the work until the pressure is released by the opening of the exhaust valve as the spindle is raised. The plunger is brought to the starting position by a stiff helical spring.

Constructional features of the fixture are shown in Fig. 9. The air cylinder is 3 in. in diameter, and is an integral part of the fixture casting. The washers rest on a hardened steel ring made so that it has six bearing surfaces. All sizes of the washers are accommodated in this fixture, the only change required being for different cutter assemblies to suit the various sizes.

Drilling of the two dowel-pin holes is done in the jig illustrated in Fig. 10. The work is supported on four hardened pins, and is centered by a plug that fits the previously-reamed hole. Clamping is done by the bushing plate. The plate is aligned with the base of the jig by two guide pins and clamps the work when the spindle is lowered.

The outside diameter of the washer is turned in one cut, a number being mounted on a mandrel at once, as shown in Fig. 11. Driving is done by a dog integral with the mandrel and fitting into a driving plate attached to the faceplate of the lathe.

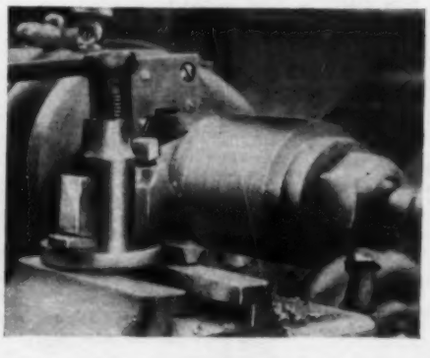


Fig. 11—A number of washers are set up on a mandrel for turning. Assembling the washers on the mandrel is done in a holding fixture. The turning operation completes the washers

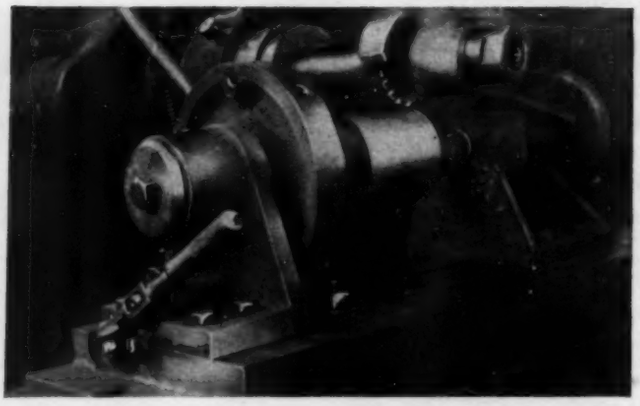


Fig. 12—Washers, in which the slots are milled, are transferred directly from the lathe to the milling machine

Washers that require to have slots milled in them are left on the mandrel upon which they have been turned, and are transferred intact to the indexing milling fixture shown in Fig. 12. Indexing is done by an index pin of the usual type, the holes into which it fits being provided with hardened bushings. Following this operation, the washers are heat-treated.

Training Future Diemakers

By E. Griffith

Foreman, Die and Toolmakers, Metal Stamping Department, Westinghouse Electric & Manufacturing Company

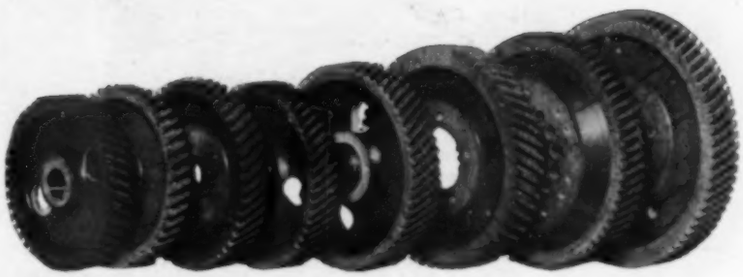
ALL EMPLOYERS of highly-skilled labor realize the difficulties of securing competent diemakers. To obviate this difficulty, the Westinghouse Electric & Manufacturing Company has given a fair trial to a plan that is showing good results. In the plant as a whole there is a well-organized apprentice department, and some of the apprentices are transferred to the die department after having had two years of schooling and training in miscellaneous shop practice.

Upon arrival in the die department, the apprentices begin work on a schedule prearranged as nearly as the production schedule will permit. After four months of miscellaneous die work on the bench, under the close supervision of an experienced diemaker, they are put to work among the regular diemakers, under the supervision of a group leader. Their work under the experienced diemaker has prepared them for handling the details of die work, so that when they are put among the regular diemakers, they are not handicapped when the group leader's attention is available only for the more important matters connected with their work. Under such conditions, it is necessary for each apprentice to use his own initiative, drawing upon the knowledge he has gained while under the supervision of the experienced diemaker.

Approximately 35 apprentices are in training on die work at one time. Those who are apparently not making good are sent before the director of apprentices for examination and instruction. If the director sees fit, they are sent back to work. If they show no improvement, they are again sent to the director for a possible placement in a line of work that is more suitable for them.

Design of Textolite Gears

By H. D. RANDALL
General Electric Company



IN 1908 the General Electric Company began research work to develop a material for non-metallic gears. The Fabroil gear, consisting of layers of compressed cotton held between metal shrouds, was first produced. Later a new type of gear material was developed. This was produced by compressing layers of cotton duck impregnated with phenol resin compounds. Gears of this material, like all other products manufactured by the company from synthetic resin of the phenol type, are marketed under the trade name of Textolite.

For gears coarser than sixteen diametral pitch, a grade of Textolite, the base of which is a 15½-ounce duck, is used. This duck is woven to special specifications, with triple twisted thread. The finished material is in the form of sheets ⅛ to 10 in. in thickness. Sheets up to 2 in. in thickness are 35 in. wide by 42 in. long. The thicker sheets are 35 in. square.

For gears finer than sixteen diametral pitch, a base of finely woven muslin or cambric is used. This Textolite comes in sheets from $\frac{1}{64}$ in. up in thickness, rarely exceeding ½ in. The smallest sizes of gears are punched, band sawed, or fly cut from this material.

When the production of a large quantity of the same gear is called for, the material is manufactured in the form of molded, or die-formed, gear blanks in order to save the wastage of material and the labor cost involved in cutting circular disks, or gear blanks, out of sheets. In molding these gear blanks, the treated duck is cut into disks of a diameter equal to the outside diameter of the finished gear. In stacking, these disks are axially staggered to obtain a uniform bias strength of the fabric. The stacks are then processed into gear blanks in individual molds.

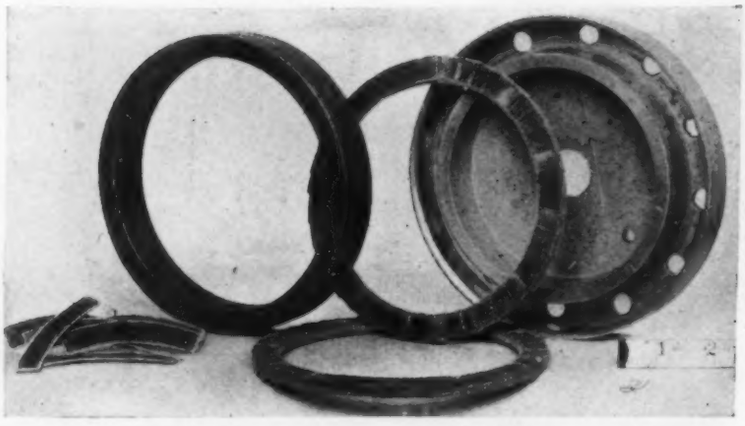
Gear blanks cut from sheet stock do not possess the strength of those cut from die-formed or molded blanks. The warp and woof lines of the fabric in the sheet stock being parallel, those teeth cut in certain relations to these lines of the fabric will necessarily be weaker and first to fail in service.

The blanks described above may be molded for plain pinions, that is, as cylinders with flat ends, or they may be die-formed with or without molded-in steel hubs, as webbed wheels. Such die-formed, webbed gear blanks not only save material, but also result in more resilient gears. Textolite ring gears, designed to be mounted on cast-iron centers, may also be molded. In any case, the quantity of gears to be die-formed must be sufficiently large so that the total savings in material will offset the cost of the special molds required.

Textolite, molded gear blanks are prepared in a large range of diameters and widths, ready for the cutting of the teeth

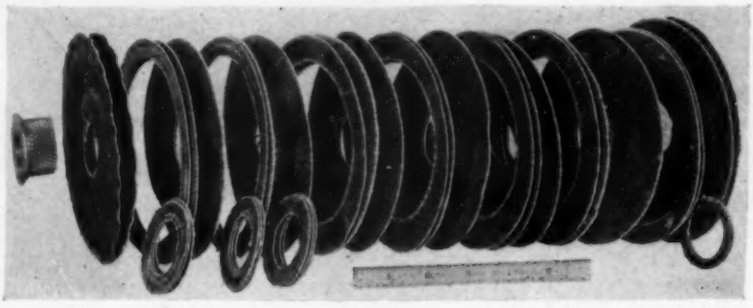
Gear board comes in 35 x 35- and 35 x 42-in. sheets. The gears are band-sawed or fly-cut from these sheets

Textolite gears may be used in any application wherein cast iron or mild steel gears would be of sufficient strength. Hardened steel gears cannot be replaced by Textolite. Generally, two non-metallic gears should not be run together, although for light service, where noiselessness of operation is an important item, as in domestic oil burners, pairs of Textolite gears may be used successfully. However, the rate of wear on the gear is considerably reduced when the non-metallic gear meshes



Cut resinized duck "segments" are used in building up die-formed ring gear blanks. They are formed into rings in a hydraulic press having heated plates

with a metallic gear. Therefore, this arrangement should always be used when the loads are appreciable. The pinion, rather than the gear, should be non-metallic, as the Textolite material is more expensive than cast iron or mild steel. The resilience of Textolite gears enables them to overcome slight inaccuracies in gear cutting, but the best results can be obtained only by careful design and machining. Both the Textolite pinion and the metal gear with which it meshes should have the same, accurately cut, tooth profiles. The diameter, pitch, and face width must be correct for the service intended. The American Gear Manufacturers' Association standards of back lash should be followed. These are determined by dividing the diametral pitch into the following constants: 0.030 in. for minimum, 0.040 in. for average, and 0.050 in. for maximum backlash.



To form a Textolite gear, cut resinized duck is molded, and the hub is inserted during the process

It is most important that the face of the metal companion gear be smooth, otherwise the Textolite gear will be destroyed quickly. Correct alignment and proper clearance are likewise necessary, as in the case of metallic gears. Gears for heavy service, or those having faces more than five inches in width, should be supported by outboard bearings.

Lubrication will prolong the life of non-metallic gears, service conditions determining the frequency of application. Machine oil can be used, but Albany grease and graphite grease are better. Pastes made of 20 per cent graphite and 80 per cent liquid shellac, or graphite mixed with vaseline or machine oil to form a thick compound, are especially good.

Textolite gears are shrouded only for heavy duties or for reinforcing the gear against strains caused by pressed fits on shafts or keys driven into keyways. For heavy duty, the gears are shrouded to the tops of the teeth; otherwise they are shrouded only to the roots of the teeth.

The face width of non-metallic gears that are not shrouded, or shrouded only to the roots of the teeth, should be slightly less than the face width of the mating metallic gear. Fully shrouded gears of not more than 7½-in. face width should have a total clearance of ¼ in. between the shroud of the pinion and the teeth of the mating gear in order to allow for end play. Wider pinions should have ⅜-in. to ½-in. clearance. Motor shafts, it will be recalled, have a standard end play of ⅛ inch.

The horsepower that can be transmitted by Textolite gears is calculated by the modified Lewis formula:

$$HP = \frac{0.000095 \times SWS \times FW \times Y \times PLV}{DP} \quad (1)$$

wherein SWS = the safe working stress in lb. per sq.in.; FW = effective face width in inches; Y = factor depending on the number of teeth, given in Table I; PLV = pitch line velocity in ft. per min.; DP = diametral pitch.

As commonly done in the design of metallic gears, the safe working stress is obtained by multiplying the permissible static stress by a velocity factor. For Textolite gears the velocity factor is computed from:

$$\left(\frac{150}{200+PLV}\right) + 0.25 \quad (2)$$

in which PLV is the pitch line velocity in ft. per min. The velocity factors obtained from the above formula will be proportionately somewhat greater than those generally used in the design of metallic gears, particularly at the higher pitch line velocities. This is permissible because the weight of Textolite is less than one-fifth that of cast iron, and the centrifugal stresses in the gears will, therefore, be proportionately less.

Sectioned views of a die-formed gear. Strength is obtained by the method of laying the fabric

Non-metallic gears cut to conform to normal commercial standards, will operate satisfactorily at a pitch line velocity of 3,000 ft. per min. With extra care in machining and balancing, and with good bearings, 5,000 ft. per min. is practical. In one application, Textolite gears are operating quietly and satisfactorily at 7,500 ft. per minute.

In the horsepower formula given above, the pitch line velocity is calculated from the known revolutions per minute and an estimated value for the pitch diameter of the pinion. The velocity factor is then calculated,

Table I—Values of *Y* for Different Numbers of Teeth

SPUR TEETH CUT ACCORDING TO THE MODIFIED INVOLUTE CURVE SYSTEM

No. of Teeth	Values of *Y*	
	14½ Deg.	20 Deg.
12	0.067	0.078
13	0.070	0.083
14	0.072	0.088
15	0.075	0.092
16	0.077	0.094
17	0.080	0.096
18	0.083	0.098
19	0.087	0.100
20	0.090	0.102
21	0.092	0.104
23	0.094	0.106
25	0.097	0.108
27	0.100	0.111
30	0.102	0.114
34	0.104	0.118
38	0.107	0.122
43	0.110	0.126
50	0.112	0.130
60	0.114	0.134
75	0.116	0.138
100	0.118	0.142
150	0.122	0.146
300	0.122	0.150
Rack	0.124	0.154

using formula (2). The allowable static stress, 6,000 lb. per sq.in. for blanks cut from gear sheet, and 7,000 lb. per sq.in. for die formed blanks, is then multiplied by the velocity factor, the result being the safe working stress to be used in the horsepower formula given above.

The value of *Y*, corresponding to the number of teeth the pinion is to have, can be obtained from Table (I). Non-metallic pinions of 3*DP*, or finer, should have at least 15 teeth; those of 2½*DP* at least 16 teeth; those of 2*DP*, 17 teeth; those of 1½*DP* 18 teeth; and for 1*DP*, or coarser, at least 20 teeth. The finer the pitch and the greater the number of teeth, the more quietly and smoothly will the gear operate, though coarser pitch gears having fewer teeth are usually appreciably cheaper to cut. However, fine pitch pinions should be used for high speeds, while the coarser pitch gears can be used for the lower speeds.

The gear tooth must be able to resist the maximum load that may come upon it. Electric motors are rated at the loads under which they operate at the best efficiency and power factor, and have overload capacity above this rating. Therefore, for ordinary service, the gears should be calculated at 50 per cent above the rated horsepower of the motor, and for heavy or reversing service, at 100 per cent above the motor rating.

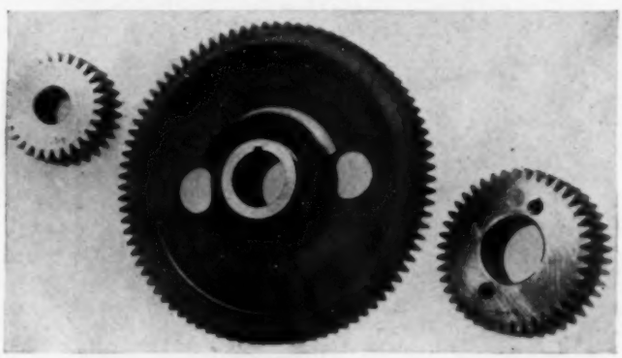
Having obtained the values for *SWS*, *Y*, *PLV*, and *HP*, these figures may be substituted in equation (1) the solution of which will then give the value of the ratio of the face width, *FW*, to the diametral pitch, *DP*. With the aid of Table (II), which is presented for the guidance of the designer, a suitable standard value for the diametral pitch may be selected, and the face width calculated. The diametral pitch chosen should be such as to give a reasonable proportion between the circular pitch and face width of the pinion.

The diameter of the pinion and the pitch line velocity may now be calculated for the gear as designed. The actual pitch line velocity must not differ from the initially assumed pitch line velocity to such an extent that it would adversely effect the design if the actual velocity were used in the calculations. If there be considerable difference, the design should be recalculated, using an assumed pitch line velocity which will more nearly approach the actual velocity.

Table II—Allowable Horsepowers for Textolite Gears

Hp.	D.P.	Hp.	D.P.
¼ or less	48–12	5 to 10	5–4
¼ to ½	16–10	10 to 15	4–3
½ to 1	12–10	15 to 25	4–2½
1 to 2	10– 6	25 to 75	3–1½
2 to 5	8– 5	75 to 200	2½–1

In the case of helical gears, which are cut with the same hobs as spur gears, the diametral pitch of the cutter is used instead of the actual pitch. For industrial service, helix angles of 10 deg. or less are satisfactory and operate without excessive end thrust. In automobile timing gear trains, angles of from 30 to 45 deg. are used. Any pitch angle and any helix angle can be used. Helical gears, although involving greater care and expense in manufacture, are recommended wherever unusually quiet running is required.



A train of automobile engine gears. The cam gear is Textolite, while the crank gear and generator gear are of steel with ground spur teeth

The Putting-On Tool—*Discussion*

J. T. TOWLSON
London, England

THE article by John R. Godfrey on page 809, Vol. 70, was very apt as to modern practice. I am reminded of the old way and the new in the case of the renovation of a valve stem of a Corliss engine.

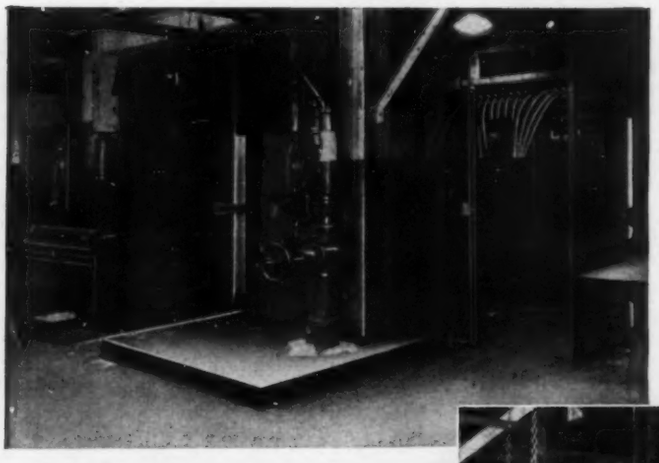
Those familiar with these stems are aware that abnormal wear occurs in the packing boxes, the wear making it all but impossible to keep such parts steam tight. The old way was to turn down and undercut the badly worn part, then to fill it up with soft metal, and re-turn to suit. The soft metal wore out rapidly.

The new way as now done by electric or by oxy-acetylene deposition is a real success. Recently a high-pressure Corliss valve broke, and the only remedy to the uninitiated appeared to be a new valve. A new valve would have been an expensive detail even without the cost of the delay. We had the broken valve welded, saved a lot of money, and got into operation quickly.

A Los Angeles factory is making effective use of radio apparatus in testing roller bearings. Flaws in the structure of these bearings produce sounds closely resembling static, and these sound waves are picked up, measured, and recorded by radio. Each bearing is tested against a fixed standard for sound volume while operating under a heavy load.

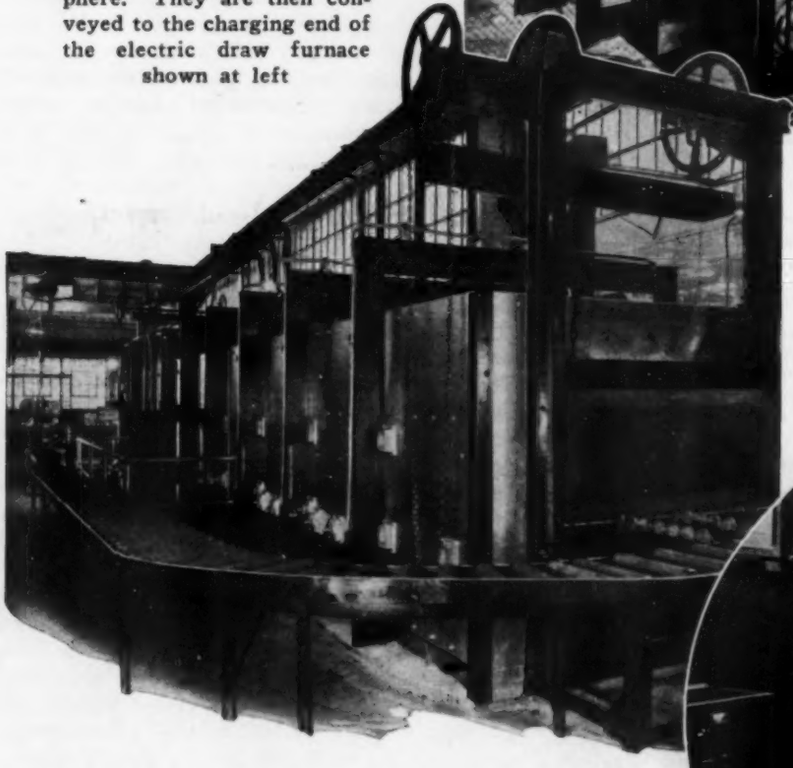
OAKLAND Heat-

Photographs by courtesy of The Electric Furnace Co., Salem, Ohio



Above—Rear axle shafts are automatically pushed lengthwise in grooves through the continuous electric hardening furnace shown at extreme left

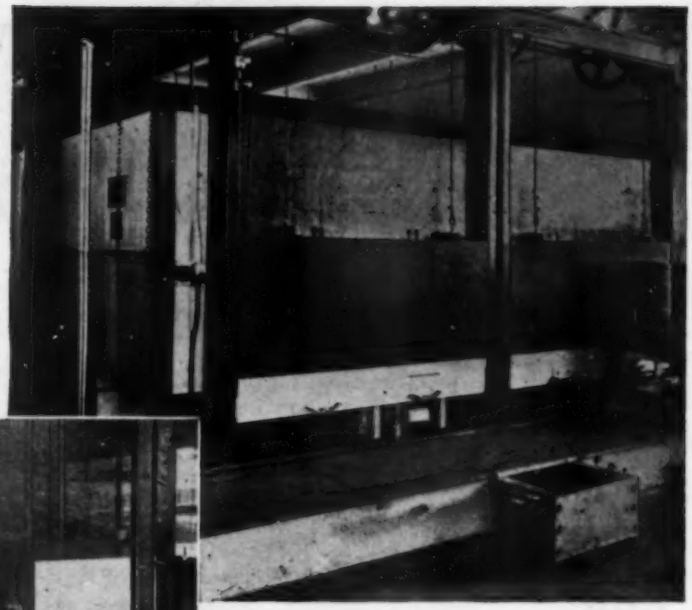
Right—Leaving the hardening furnace, the shafts are oil quenched without coming into contact with the atmosphere. They are then conveyed to the charging end of the electric draw furnace shown at left



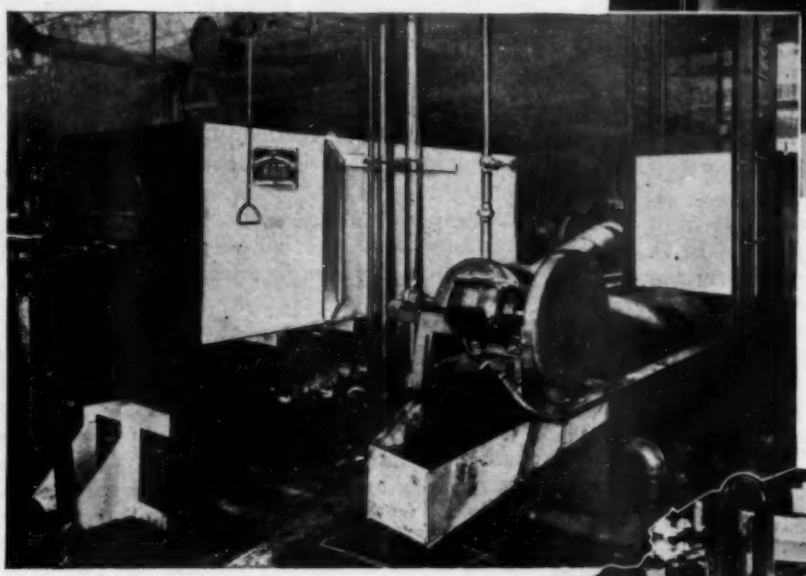
Left—Discharging end of a 135-kw., automatic, pusher-type, electric furnace for annealing transmission gears. The material is conveyed through the furnace in pans on roller rails. The gravity carrier system conveys the material away from the discharge end of the furnace

Right — Controllers, recording instruments, and switches for controlling all furnaces in the heat-treating department are placed in a conveniently located room. The switchboard is located on the opposite wall. Transformers are placed above the switchboard

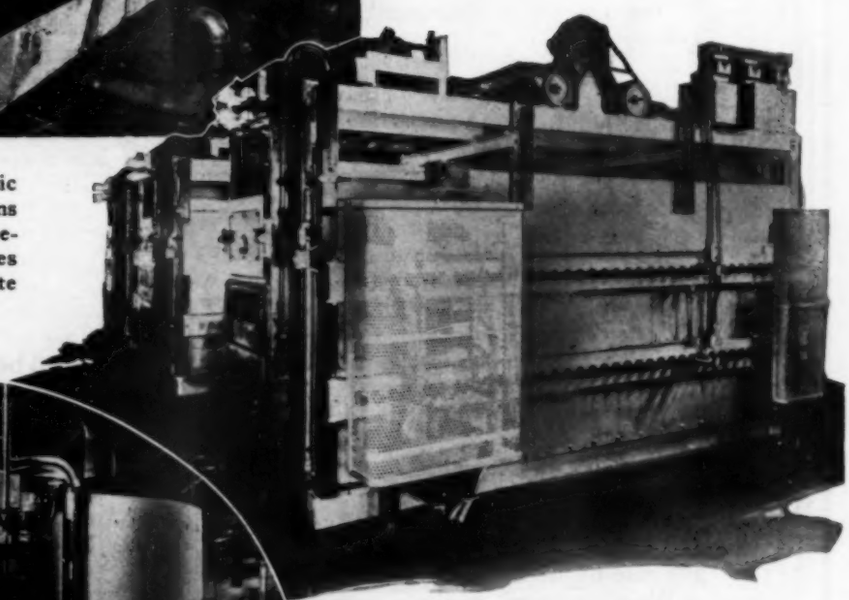
Treatment Control



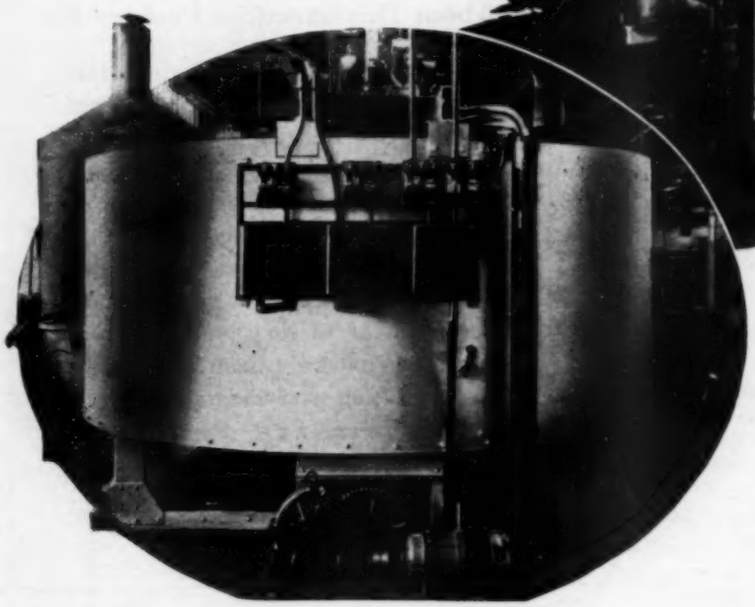
Above — A 300-kw., double-chamber, continuous-counterflow, recuperative furnace, completely automatic, for carburizing drive gears and differential gears



Above — Two pusher-type, electric furnaces for hardening piston pins and other small parts. The material is pushed through the furnaces in grooves and dropped down a chute into quench tanks



Above — Three, 120-kw., "double deck," roller, hearth furnaces for hardening ring gears and other parts. The double deck feature saves 50 per cent of floor space and enables one operator to feed both chambers without changing his position



Left — Rear view of the 100-kw., rotary furnace for hardening transmission gears and parts. The gears are removed from this furnace and placed in the cyanide pot

EXECUTIVE · FORUM

How Long Should Records Be Preserved?

HE REACHED for his signature stamp. inked it mechanically, and pored over each item in the long purchase order.

"Whew!" said Allan B. Ferguson, P. A., to himself, "Whew! Eleven hundred and thirty-five blink-blank dollars for blink-blank, letter-size transfer files in one item alone. The stuff that we file away every year isn't worth it.

Tossing the signature stamp into the desk drawer, he picked up the orange-hued P. O., and strode toward the office of the vice-president and general manager of Brentford Special Machinery Corporation. Albert Weiss was at his desk.

"Busy, Mr. Weiss?" asked Ferguson.

"Not any busier than usual, Allan. What can I do for you?"

"Just this, Mr. Weiss. I have been purchasing agent of this organization for over seven years. Seven years ago today I was called upon to sign an order for new transfer files, and every year thereafter. Please look at this P.O."

"But we must preserve our records," said the vice-president. "Suppose we got into an argument with a customer; suppose a customer had a breakdown on a piece of special equipment and needed a quick repair; suppose we were caught in a jam on federal income taxes; suppose a customer brought a lawsuit against us. What then?"

"Well, sir, we should do just exactly what we have been doing all during the years that I have been here; we'd search frantically through transfer file after transfer file, and then we'd settle the case on its merits."

Weiss appeared ready to protest, but the purchasing agent continued.

"Mind you, Mr. Weiss, I believe that as long as we are in the special machinery business we must keep accurate engineering records to protect our customers. And as long as Uncle Sam appears to enjoy checking our books against our income tax returns—well, we'd surely preserve our books anyway.

"What I'm fuming about are the stacks and stacks of transfer files containing old correspondence which will never be referred to even if it could be found. They take up a lot of valuable space. Why we've got all our orders running back to the day this business was founded, all our time tickets, copies of all our purchase orders, and what have you—"

"And what else?" interrupted Weiss. "I'll bet you've been talking to that old radical, Bill Holland, again. Am I right, or am I not?"

"You're right, Mr. Weiss."

"What did he have to offer?"

"Well, one thing he said was that some of the mail order houses are destroying their orders and correspondence on the very day that the orders are filled. The customer is always right, anyway, so why not? One house was filling over one hundred thousand orders a day, and you can see how much filing expense they saved themselves.

"It's out of my line, but Holland gave me the outline for a plan; I'd like to whip it into shape and lay it before you. Then you can call us all into a huddle whenever it is convenient to you."

What Do You Think About This Executive Problem?

What plan do you imagine Holland proposed to Ferguson? What plan will Ferguson lay before Weiss?

Should records be preserved during the period of the "Statute of Limitations?" What has been your actual experience in the preservation of factory and sales records? What have been your losses through non-preservation?

Executives are requested to write *American Machinist* their candid views for publication.

DISCUSSION
OF PREVIOUS PROBLEMS

The Night Shift

In any industrial community there are always a few workers who are personally so situated and unobligated that it makes little difference to anyone but themselves if they choose to work nights. But if the temptation of shorter hours and more money were placed before all the workers, how about the man with a large family of children who would try to work nights, and the resulting difficulties of restraining children in the daytime so he could sleep? In gaining his shorter hours, the employee might lengthen the hours of his wife, and add to her troubles the preparation of special meals, the nervous tension of restraining children, and a restriction of opportunity for mental recreation at the end of the day.

Then, too, the man on the day shift would begin to ask the boss for shorter hours, or at least as much pay per hour as the night-shift man receives. In time the night shift might even become the preferred shift, as far as the men alone were concerned. As a consequence, the whole industrial status might be upset. If only one manufacturer employs a night shift, he may gain an advantage without any of the attending difficulties. Perhaps that is the reason the other employers in the case cited object, because the plan is not fair to the whole group, and may lead to trouble.

—JOHN S. MORAN,
Naval Aircraft Factory, Philadelphia.

Several years ago a firm manufacturing heavy machinery had considerable trouble getting men to work on the thirteen-hour night shift. The day shift worked ten hours, and the men coming on at night could see the men who were leaving at the close of the day shift and find out how the various jobs stood. This plan was desirable, but unfortunately the class of help on the night shift was not of a caliber high enough to handle the work efficiently. The work could not be done by the day shift because there was not room enough for the plant to expand.

The problem was solved by starting the day shift at 6:30 a.m. and running it until 2:30 p.m., with a short lunch period at 11 o'clock. On Saturdays the shop closed at 12:30 p.m., making a 44-hour week. The night shift started at 2:30 p.m. and ran until 12 midnight, five nights each week, also making a 44-hour schedule, with lunch periods taken out. On each shift the men were paid straight time, the week's pay comparing favorably with other shops in the neighborhood working 50 hours. The plan has been in force five years and is still working satisfactorily. Labor turnover is small. The men who work on the day shift like to have the afternoons off, and the night shift is composed of men who dislike rising early in the morning.

—L. F. SWENSON, *Industrial Engineer, Perkins Machine & Gear Company.*

Insuring Machines Against Undue Wear

The safety appliances on lubrication systems are seldom anything more than warning devices. Usually, they give the alarm only when the whole system fails, although most breakdowns result from the failure of only a part of the system. I have in mind one occasion on which the warning bell of an elaborate lubricating system, fitted to a large turbo-generator, rang loudly. Steam was shut off instantly, but a bearing seized before the turbine stopped.

There occur to me three other instances of lubricating system failures that probably would not be covered by insurance. In one case, carelessness in cleaning a filter resulted in the plugging of a branch pipe with a bit of rag. In another instance, finely powdered abrasive got into the system from an unknown source. In the third, a branch pipe was flattened by a spanner when it slipped off a nut.

Insurance against trouble from faulty lubrication appears to be a highly speculative undertaking, except perhaps in the case of splash or flood lubrication, and no one would be willing to pay for protection with these systems. Some insurance company may be willing to issue policies and assume risks, but at the present stage of machine tool development the subject is not an engineering problem.

—H. JAMES, *Birmingham, England.*

Does a Highly Developed System Pay?

A good, practical system simplifies complex situations, affords smooth and co-ordinated flow of work, eliminates duplication and overlapping of activities, and controls costs and expenditures effectively. Such a system, however, can be developed only by men of wide experience and clear judgment.

In the case cited, regarding the Northwestern Manufacturing Company, it appears that petty matters hampered production. The main trouble was lack of initiative to act according to independent judgment. A slip in a purchase requisition can be rectified in a few moments. A clerical discrepancy should not be allowed to hold up the work of adjusting a couple of machines. Regarding the trouble between the receiving and inspection departments, it would seem that receiving should be directly under the administration of the inspection department, inasmuch as articles and raw materials purchased must be examined and tested before final acceptance.

—GEORGE BELBES.

Entertaining—And How Much?

Entertaining can never be entirely eliminated. However, the extent to which it is carried by the employees of any company should be regulated by a definite policy laid down by the management, but, never by the sales manager alone.

Lunches and dinners come under the head

of entertainment, and these items, the least objectionable of all forms of entertainment, are often necessary in the course of effecting sales. If salesmen are not allowed to enter them on their expense sheets, they are up against the necessity of recovering the money expended by camouflaging the items under other headings.

If a concern, such as a large tire manufacturing company, has several thousand salesmen on the road making several calls a day each, these individual salesmen cannot be permitted to open entertaining accounts. Too much abuse would creep in. On the other hand, the company that is trying to sell to the tire manufacturing company a contract for a six months' supply of fabric could well afford to spend a considerable sum of money in connection with securing the order. If the purchasing agent of the tire company happens to be a man who takes kindly to prize fights, theatrical parties, and other forms of entertainment, the sales manager of the fabric company would hardly be called efficient if he did not play up his hobbies. If the owners of both concerns object to doing business in this way, it is clearly up to them to express a definite policy on the subject.

—JAMES K. MATTER,
Supervisor, Main Press Shop,
The E. G. Budd Manufacturing Company.

What Shall We Teach Apprentices?

This question, I believe, should be worded "How shall we teach apprentices?" An experience of three years as civilian instructor in the workshops of the British Royal Air Force convinces me that, to get the best results, we require first class workshop instructors, who have, besides a knowledge of their craft, an understanding of students, secured only by lengthy experience, co-ordinated with an ability for teaching.

The course should comprise shop practice, shop mathematics, machine design, and a study of the correct uses of machines. The shop practice should include the following periods of work: On the bench, six months; in the machine shop, six months; in the blacksmith shop and foundry, three months each; in the drawing room, six months; in the production division, six months; in the tool room, six months.

Twice a week, a whole afternoon should be devoted to lectures, and homework should be assigned on shop mathematics and problems connected with the machining of various parts.

The apprenticeship course should cover a period of about three years, the first six months to be probationary service to find out the type of work for which the apprentice is best suited. Prizes should be offered annually for progress made in the work. The instructor himself should be paid as a shop superintendent.

—R. L. HASELGROVE, *North Harrow, England.*

A large industrial concern in the Metropolitan area selects its apprentices preferably from among high school graduates. The boys are given a two-week course under a capable instructor, the various machines used in the work being thoroughly explained to them, and the requirements of the apprenticeship course outlined.

The next two months are taken up with business economics, after which the apprentices are transferred to the machine-shop school. Simple operations on small parts are assigned to the boys, their progress to more difficult work depending entirely upon their individual ability. After six months, the schedule is changed to include four hours of technical study and four hours of machine work each day. The subjects taught include mathematics, business English, mechanics, physics, and small design problems. Shop work is correlated with the theoretical instruction. The problems worked out in the classroom are later reproduced in machine work which, when completed, is brought to the class instructor for inspection and discussion.

At the end of three years the boys who have completed the course successfully are graduated and placed in positions which best fit them. If a boy attains an average of 85 per cent, or over, for the completed course, he is awarded a scholarship covering a five-year engineering course in an evening technical school in one of the nearby cities.

The system just described has been in service for eight years. During this time the output of the plant has tripled. The plan has been so successful that it is proposed next year to place the apprentice training school in a separate building.

—FREDERIC A. J. SCHMIDT, *Industrial Engineer, Western Electric Company., Inc., Kearny Works.*

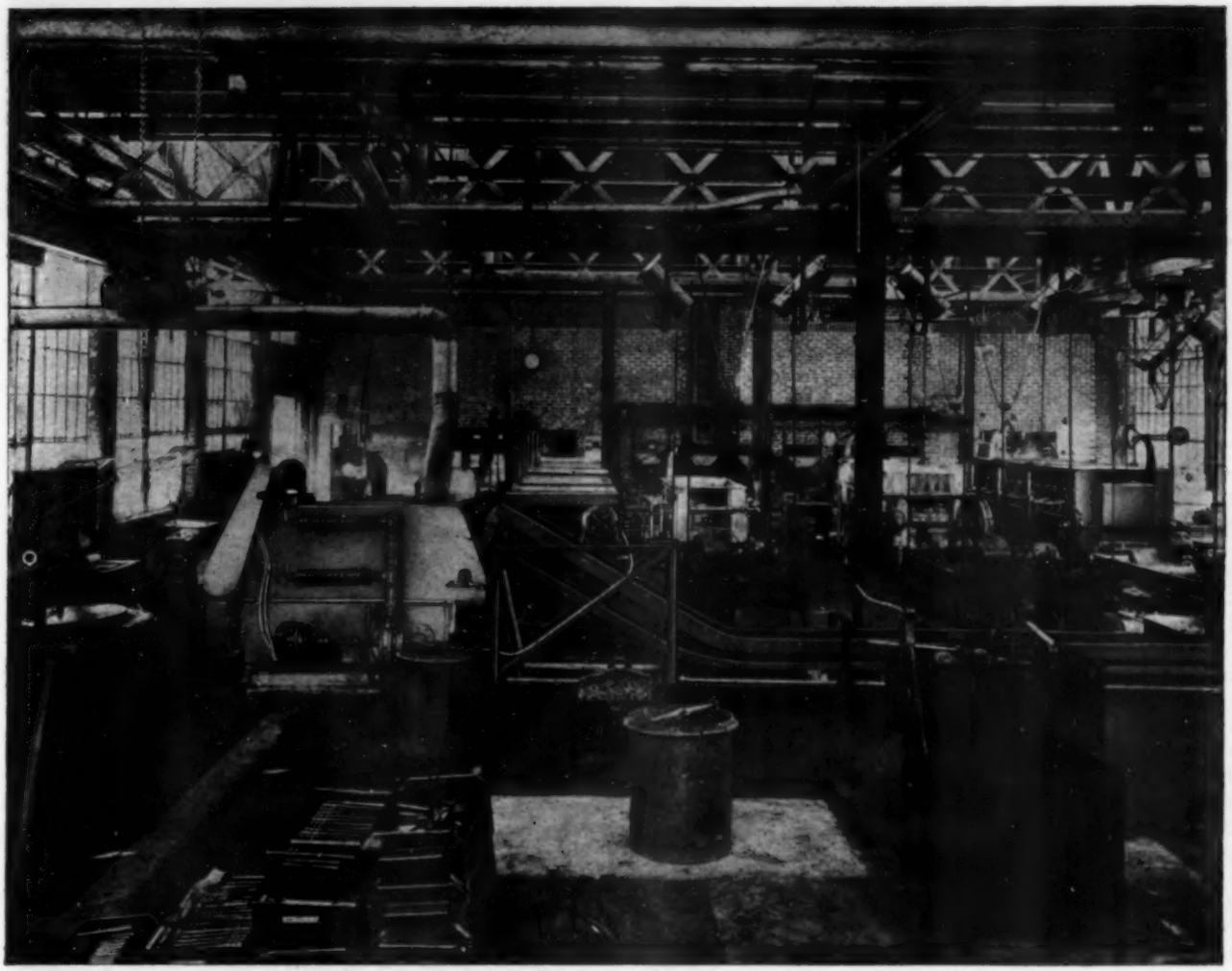
Entertaining—And How Much?

If the word hospitality were to be substituted for the word entertainment, when identifying funds spent in gaining the favor of buyers, there would be a change in the attitude towards such expenditures. The accredited representative of a company should be regarded as a responsible individual doing all he can to impress the customer with the value of his company's product. If a theatre party is necessary to clinch a big order, that party should be given.

The company that does not allow its representatives to be entertained should refrain from entertaining representatives of other companies. The ensuing loss of orders that would probably follow would make the company realize the important part that hospitality plays in the business world.

Some companies send observers to machine tool expositions for the purpose of finding out how certain equipment can be adapted to economical production. These men are not buyers and may not have any influence on the purchasing operations of their company. The salesman who spends time and money entertaining such visitors to the show has only himself to blame if his actions create an unfavorable impression either in his home office or at the headquarters of the men who are entertained.

—SAMUEL KAUFFMAN, *Engineering Dept., Hess-Bright Manufacturing Company.*



HEAT-TREATING
Aircraft Engine Bearings

By J. B. NEALEY

IN THE manufacture of a spheroidal type of bearing for aircraft engines, the S.K.F. Industries, Inc., uses a Swedish steel that somewhat resembles the S.A.E. 52,100 steel. It has a chromium content of 1.40-1.60 per cent, with a phosphorus maximum of 0.025 and a sulphur maximum of 0.02 per cent.

Upon receipt of the steel at the factory, a sample from each bar is sent to the laboratory and tested for hardness, strength, and grain structure. This analysis, together with the proper heat-treatment instructions, is noted upon a card that follows the work through the different operations.

Races of 6-in. diameter and under are turned from the bar. Races of 6 in. to 24 in. are forged, and afterward machined.

The races and cages for this spheroidal type of bearing are heat-treated in a department recently installed at the Hartford, Conn. plant of the S.K.F. Industries, Inc. This department is supplied with a complete equipment of furnaces, controls, and conveyors. In addition it has an automatic fire extinguisher stationed at each oil tank.

The larger races, those machined from forgings, are heated in a bank of five, box type, gas-fired furnaces. These are 4 ft. long and 5 ft. wide. They are underfired and semi-muffled. The parts are handled manually, and two large water tanks are provided for quenching purposes.

Most of the work is heat-treated in three, long, gas furnaces which are continuous and automatic in oper-

ation. These are constructed of brick, suitably encased and stayed. The gas burners are located along the sides, throwing the fire under the work. The first, and smaller furnace, is provided with a shaker hearth, a type but little used in this country. This unit is 10 ft. long, 3 ft. wide, 2 ft. high, and stands on 2-ft. legs. It has nine gas burners.

The alloy steel hearth is 15 in. wide, with flanges on each side to keep the work in line. It extends 4 ft. beyond the charging end to form a loading table. This hearth is movable and is operated through a cam and link motion which causes it to travel a short distance forward slowly, and to jerk back quickly. This causes the work to progress along the hearth. The time interval can be regulated to suit the work being treated.

At the discharge end of the furnace, close to the end wall, a steel chute runs down into a quenching tank one end of which projects beneath the furnace just far enough to receive parts from the chute. The tank is provided with an elevating conveyor which receives the work, carries it along through the quenching medium, and then elevates and drops it over the end into a tray for further handling.

This tank is 10 ft. long, 4 ft. wide, and 5 ft. deep. The quenching medium, which is oil, is circulated by means of a motor driven impeller. Another motor operates the conveyor.

The correct temperature is maintained in the furnace by an automatic temperature control, consisting of solenoid valves on the gas and air feed lines, actuated by thermocouples within the furnace. When the furnace temperature rises above that set on the dial, the valves close and shut off the gas and air supply. When the temperature drops, they automatically open.

There are two other furnaces, similar in construction but somewhat larger, one being 18 ft. long and the other 20 ft. These are about 4 ft. wide and 5½ ft. high including 2-ft. legs. They are fired with 12 gas burners and are automatically controlled as to temperature in the manner just described. All are provided with recording pyrometers.

The conveyor hearths of these two units are unusual in heat-treating furnace design. The hearth consists of a series of alloy steel rollers set close together and extending across the furnace to form a continuous platform throughout its length. These rolls project through both side walls, and are provided with sprockets which are driven by a closed loop of sprocket chain on the outside of the furnace. Though the rods remain stationary in the furnace, the rotating motion given them by the chain causes the work to progress through the furnace. The chain is motor-operated through a speed reduction gear train which can regulate the furnace heating cycle.

These two furnaces are provided with quenching tanks having apron type, elevator conveyors. Each tank is equipped for oil circulation. Another feature of these units is the automatic fire control system provided for the oil quenching tanks. This consists of a series of fan shaped nozzles distributed about the edges of the tanks, so placed that they will play a stream onto the surface of the oil. Above the oil tanks are located storage tanks of a fire quenching chemical connected to the nozzles by a system of piping. Just above each tank is hung a safety link of a low-melting-point alloy. In case of fire, the heat melts this link, and the chemicals are automatically released and sprayed into the tanks.

These three furnaces are placed side by side in such manner that the discharge ends of their quenching tanks are in line. Here, the tray system of handling has been supplanted by a continuous traveling conveyor onto which the elevator conveyor in each of the quenching tanks discharges. This travelling conveyor takes the work to, and through, an automatic washing machine, and then discharges it into trays for further handling. An overhead traveling crane of 25-ft. span is used for handling the heavier work.

The temperature of the quenching oil in the tanks is automatically controlled and held at about 110 deg. F. by pipe coils within the tanks. Cold water is circulated through these pipes, and whenever the temperature drops, a valve automatically shuts off the water, but allows it to flow again when the heat rises above the point set.

The steel parts are heated to 1480-1560 deg. F., according to the physical characteristics required, a ten degree variation being allowed after the exact determination has been made. They are drawn at 350 deg. F. which ordinarily gives them a Brinell of 655.

The heat treatment given the Duralumin cages consists of heating them to 950-960 deg. F., quenching in water or oil at from 100-212 deg. F., and ageing for 48 hours at room temperature. This gives the metal a tensile strength of 62,000, a yield point of 30,000-36,000, and an elongation of between 18 and 25 per cent in two inches. A Brinell of 93-100 results.

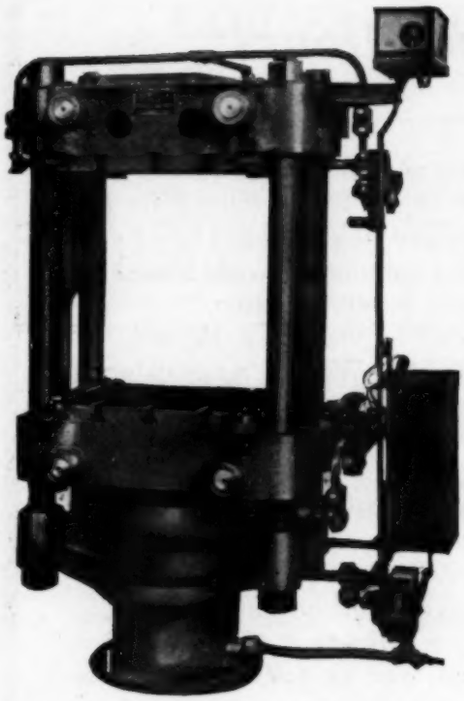
The tool hardening section of this department is equipped with several small gas furnaces for various heat-treatments and a larger one for carburizing. One unit in this section consists of a gas furnace with three heating chambers, one above the other. This furnace, which is virtually a steel jacket lined with carborundum brick in the lower chamber and with firebrick in the upper two, is circular in shape, about 2 ft. in diameter, and 4 ft. high. It sets on 3-ft. legs. It is heated with a single gas burner located in the lower chamber. The ports between this and the upper chambers are so arranged that there is always an exact differential between the temperatures of the three chambers. Usually the lower chamber is maintained at 2300-2400 deg. F. and the others at 1600 and 1100 deg. F. respectively. The work is preheated in the middle chamber, heated for quenching in the lower, and drawn after quenching, in the upper.

In the Next Number

Both because it is almost traditional to welcome the Happy New Year with a review of the old, and because it is essential that American Industry possess reliable facts upon which to base future plans and development, the American Machinist proposes to review 1929 in the next number.

The Semi-Annual Shop Equipment Review will be Number 3 of the new volume.

Time-Cycle Control Units



Photographs by courtesy of the Automatic Temperature Control Company

Fig. 1—Time-cycle control equipment that regulates a two-pressure, hydraulic press for Bakelite molding. The equipment starts by push button, runs a four-step cycle, and stops. The first step closes the exhaust valve and opens the low-pressure line to the ram. The second step opens the high-pressure line to the ram and applies the final squeeze after the press is closed. The third step closes the high pressure-line. The fourth step opens the exhaust line from the ram and, at the same time, stops the timing unit

Fig. 2—Timing unit of the cycle-repeat type, geared for one revolution in ten minutes on 110-volt, 60-cycle current. The unit controls a 440-volt, 60-cycle, 2-phase motor which rotates periodically the gas furnace shown in Fig. 3. The contact disks are adjustable in relation to each other, so that the retort motor runs any desired percentage of the cycle

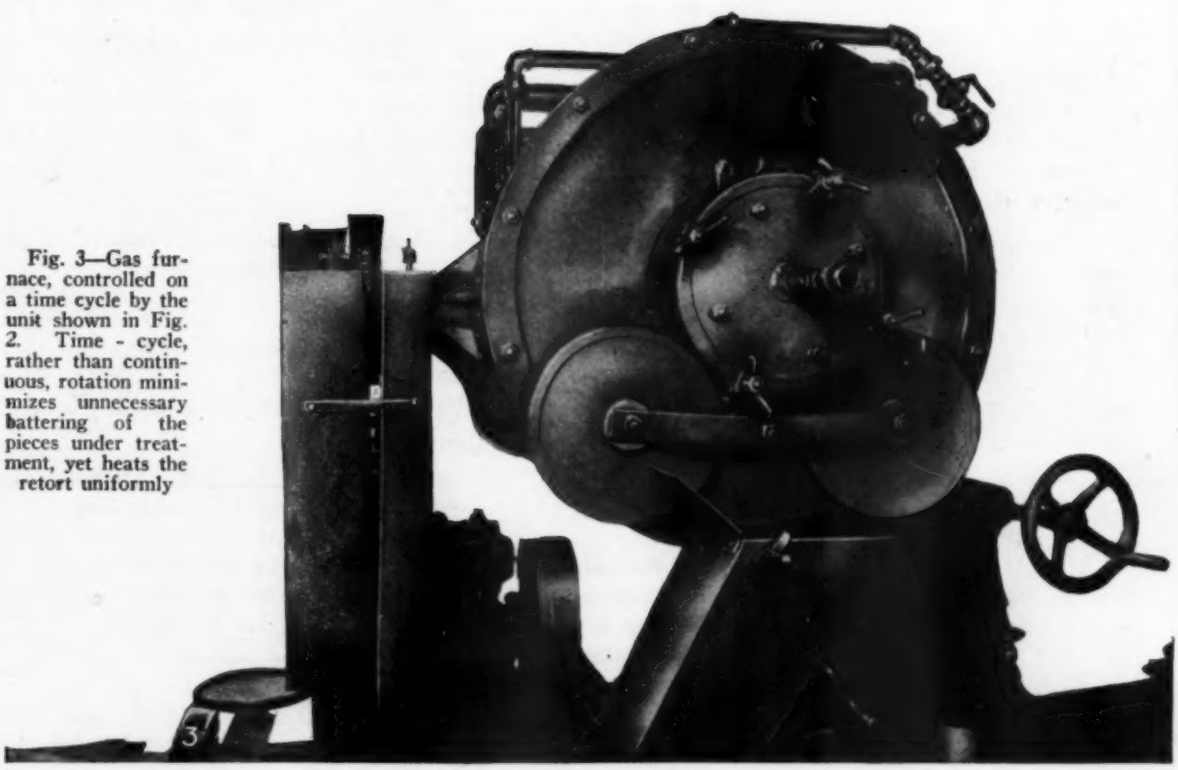


Fig. 3—Gas furnace, controlled on a time cycle by the unit shown in Fig. 2. Time - cycle, rather than continuous, rotation minimizes unnecessary battering of the pieces under treatment, yet heats the retort uniformly

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions given at the foot of the page have been prepared

THE · FOREMAN'S

Smoking During Working Hours

AL LOOKED up in surprise as Ed burst into his office and, without any preliminary greeting, began, "You have always preached that this company tries to treat all its employees alike, haven't you?"

"Yes, I have."

"And you've always said that Williams was ready to go to the mat with any of the office force that high-hatted the shop, haven't you?"

"Yes, but why—?"

"And," Ed kept on, "you have told me that, aside from shorter hours, the office force had no privileges that the shop did not have. Those are your very words. But I'm here to tell you that the whole thing is a lot of hooey."

"Wait a minute, boy, wait a minute. Again I ask, 'Why all the soap box oratory?' I thought you were a pacifist."

"I am, but I want to ask you if the signs in the shop that say, 'Smoking will void our insurance,' mean me and my men alone, or whether they mean everybody."

"Oh! so that's the trouble. But why get excited about smoking, all at once? Couldn't you think of anything else?"

"Why? This morning, when I was feeling real virtuous because I was resisting the temptation to sneak a smoke, that assistant purchasing agent I don't like came into the shop. The big stiff stopped at the new milling machine where I was talking to Jim Baxter, and asked how we liked it. Every time he asked a question he would blow a big cloud of smoke in our direction."

"Is that what set you going, big boy?"

"Let me finish. While I was talking, I could hear one machine after the other shut down, and I knew that half my force was sneaking off to the washroom for a smoke, but I was so mad I didn't care. Finally he left, and I turned around to speak to Jim, and I'm darned if he hadn't gone too. Why can't Williams do something about it?"

"Williams is wise to it, but he doesn't smoke himself, and he feels it might look like he is forcing his own personal opinion upon others. He thinks that maybe a short smoking period morning and afternoon might be a solution."

"It won't be a solution, it will only be something else again. It won't prevent office men smoking when I can't, and that's what I resent."

"Maybe, if you took it up with Williams, it might start some action."

"It sure would, but not in the way I crave action."

"How come?"

"Well, I went out for a smoke too, and Williams saw me."

Should a shop man be disciplined for breaking a rule of personal conduct that the office man does not have to observe? Should office men and visitors be allowed to smoke in the shop? Would a short interval, during which smoking is allowed, be a good solution?

All foremen are urged to discuss these questions vital to their work; of course the

ROUND · TABLE

DISCUSSION OF EARLIER TOPICS

Paying for Dependability

I AM certainly happy to see Al step forward and register his appreciation of the dependable man in a practical way. In our natural, but sometimes over-emphasized worship of "Production," we often lose sight of the dependable man who, by the assumption of the more intricate and special problems in the shop, often makes possible the high production of others on simpler work.

Often the dependable man is taken too much for granted and his worth really appreciated only after he is gone. If production is the most important item, then he is the one who makes it possible for the foreman to devote the major portion of his time to production. A busy shop encounters many unusual problems in the course of its activities, and if a man can be depended upon to solve these with a minimum of supervision, and a maximum of quality results, then that man is a mighty valuable asset, worthy of a raise. —HARRY A. GOSLAR.

*

Games at the Noon Hour

I BELIEVE games at the noon hour are beneficial, provided they are well selected and reasonably controlled. For instance, a baseball game for office workers in the summer sun, which leaves the players excited, hot and dusty, without proper time and facilities to cool off and clean up, is an ill-chosen sport. For these same employees, a horseshoe game, in a shady spot, and with not too long a pitch or too heavy horseshoes, is a much more suitable game. The shop man can obviously stand more physical exertion, but here the element of quick thinking and skill should be emphasized, as in handball.

I believe such games not only relieve the monotony of repetition, but they can also be made valuable in other ways. Foremen, supervisors, and executives should, at least occasionally, join in. If they are successful executives, they will usually make up for what they may lack in physical stamina, by their alertness, concentration, and strict application to the sport of the moment. Many an indifferent worker and player will learn a valuable lesson by observing how the "boss" puts all he has into whatever he tackles, even though it is a game at which he is obviously not skilled or experienced. Very often the men will get a new slant on the energy of the "boss," a quality which he has not always appreciated in its true light on the job. —BERNARD F. MCCORMACK.

Tempering General Purpose Tools

IT IS my opinion that certain tools do need more personal care than is given them in the average heat-treating department, and that automatic control and specifications are but a means whereby certain results, once obtained, can be duplicated without using the same personal care as was extended to the original tools.

The heat-treating specifications supplied with purchased material should be used as a guide only. Sam Hudson drew on his store of personal knowledge whether to make the tools harder or softer. As this knowledge is now lost to the plant, Ed and the new head of the heat-treating department should co-operate to the extent of determining the proper grade of tool steel to use on each class of material, also, several degrees of tempering each side of that recommended should be tried out. The record of the life of these tools on the several materials will point out the course to follow.

Automatic controls and specifications were never intended to replace skilled help entirely, although beyond a doubt they do lessen the need of such help after definite standards are established. They are mainly intended to insure uniformity after a particular result is once obtained, and make it easier to obtain that particular result again. —F. L. INGLERIGHT, *Superintendent, Bradford Motor Works.*

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Should the Workman Share Responsibility?

THE episode, as described by Ed, brings out a lot of human nature. To begin with, had Ed given his man full instructions as to the use of the jig, a good man would not have spoiled the job. After the work was spoiled, Ed saw where he had erred in the instructions, and at that point, to defend his position, he put the entire blame on his workman, being too small to confess his own shortcomings.

Blaming the failure on the man naturally excited the man's ire, and hence the uncivil "comeback." Ed fired the man because he lost his temper, all starting from his hasty and superficial instructions. —HENRY E. BILGEN.

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Buying or Making Special Tools

THERE are several things to be considered before reaching a decision in regard to buying or making special tools: the shop equipment, the number of tools to be made, and the ability of the mechanics in the plant to make them with the desired accuracy. It is not to be expected that men building engines can make taps and dies as accurately as the manufacturer of taps and dies. Neither can they make them as cheaply. If there are only a few special tools to be made, it would be far better from an economic point of view to buy them.

—W. J. OWENS, *Foreman, Newport Rolling Mill Company.*

BUYING special tools rather than making them in the tool room is but one manifestation of the trend towards specialization in industry. It is the logical result of the application of the economic principle of

discussion is not limited to foremen. Letters accepted and published will be paid for

division of labor. Just as a man who concentrates upon one particular part becomes exceedingly skilled in the making of that part, so does the plant which concentrates upon the making of one class of tools, or parts, become more capable in this work than the plant which has many different activities. The point which Ed overlooks is that the manufacture of special tools is the main and principal business of the specialist. He concentrates his organization and engineering skill on them, whereas, in the other organization they may occupy a comparatively minor place. —H. GREENHALF,
Walkerville, Ontario, Canada.

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A Bonus for the Ambitious

THE ambitious man should be aided in his mental growth by the company that employs him. An educational bonus is one of the greatest aids in the making of efficient workers. It is a curious but significant fact that men from six to eighteen or twenty years of age, while under school discipline, are continually enriching their minds through the accumulated experience of others, yet the moment they enter factory life, their rate of mental growth is likely to be confined to their own somewhat limited experience. This is a serious limitation, and in order that it may be corrected, many employers are maintaining a shop library, while others provide free home-study courses, or give advice and encouragement in the study of educational books and correspondence systems. The rapid growth of our schools and colleges, the installation of extension and correspondence courses in connection with the large institutions of learning throughout the country, and the known advancement of men who have been trained by these methods, is proof of the value of proper technique.
—HARRY KAUFMAN, *Public Accountant.*

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When Do Automatic Machines Pay?

AUTOMATICS pay, in the first place, because they make it possible to cut machine costs and thus lower the price of the product. This reduction in cost increases the demand for the article, for it may be accepted as an axiom that the lowering of the sales price increases the sales. The increased demand, in its turn, calls for increased capacity and absorbs the labor originally displaced by the use of automatics. I think that if Ed has sufficient work to keep an automatic machine busy half the time, he might get Williams to reconsider his decision.
—R. L. HASELGROVE,
North Harrow, Middlesex, England.

I WONDER if Ed took into consideration the hourly rate to be paid to a set-up man, or the fact that one machine would not require the set-up man's entire time. Recently, a certain firm purchased a 54-in. bevel-gear generator which was set up beside a 14-ft. spur-gear planer with the intention of having one operator care for the two machines. The results have been unsatisfactory, as the planer is idle from 25 to 50 per cent of the time. The labor cost on the generator, therefore, is high, indicating that it should be distributed over three machines instead of two. —ROBERT A. WATKINS.

A FEW years ago, in a large automobile factory, we were confronted with the proposition of doubling our production output, and as our machinery was considered obsolete among the more advanced industries, it was the duty of the Engineering Department to study the necessary steps to be taken. We gathered data pertaining to the savings which could be effected by the installation of light-, and heavy-duty automatics in place of the old type machines. We then worked up the data necessary for comparative purposes and found that, where a large quantity of each type of power is required each month, automatics will pay for themselves in a short period of time. We found, after a period of one year, that we had replaced 136 old type machines with 42 automatics, and that production had been practically doubled.—FREDERIC A. J. SCHMIDT, *Industrial Engineer, Western Electric Company, Kearny.*

* * * *

THE · NEXT · TOPIC

"New Drills and Old Men"

When Do Automatic Machines Pay?

SUMMARY OF THE DISCUSSION

Ed made application for an automatic machine, but failed to submit any data showing possible economies from its use. Williams's reaction to the suggestion was disappointing, much to Ed's surprise. Al was sympathetic, but pointed out that automatic machines, especially single ones, are not necessarily an economy, and that the time to find out whether they are or not is before, not after, purchase.

THAT automatic machines are economical just because they are automatic, is no longer the view of those who analyze. Each one of the contributors to the discussion stressed that point, or mentioned it as an established fact.

It was also brought out that a single automatic is seldom, if ever, cheaper than a hand machine: a full automatic machine with a hopper, or bar feed, that does the same operations continuously may be an exception to this rule. One contributor gave specific examples of work on which automatic machines could not compete with manually operated ones.

There is no reason why an automatic machine should cut faster, or complete its cycle of operations more quickly than a manually operated machine. The advantage lies in the fact that automatics are continuous, and that several of them can be operated by one man.

An industrial engineer told of an automobile factory which substituted 42 automatic machines for 136 manually operated ones, and at the same time, doubled the output of the department.

By R. N. DETZER
Assistant General Manager
Detroit Vapor Store Company

Conveyors and production-type furnaces are responsible for improving the quality and keeping the product always on the move

From the mono-rail in the far background, the work is loaded into the rotary "burning" furnace, after which it cools without warping on the "caterpillar"

Enameling Stove Parts *in the Modern Manner*

IN FOLLOWING the modern trend towards standardization and simplification, the stove and range industry has discarded many of the models formerly manufactured, and is devoting its efforts to a few standard models. Thus, it is able to adopt continuous mass production.

A particularly ingenious use of mass production is being made in porcelain enameling, where it simplifies operations, reduces labor, increases output, assures accurate control of functions, improves quality, and reduces spoilage. At the Detroit Vapor Stove Company, for example, the enameling process is continuous from the time the parts come from the press room until they leave for the assembly floor. Handling is reduced to a minimum, and only a relatively small amount of unskilled labor is required.

The complete system comprises a pickling conveyor, three rotary furnaces, three drying chambers, three connecting systems of monorail conveyors, three straightening "caterpillars," and a belt conveyor which takes the finished product to the assembly floor above. In all, less than two hours elapse between the time a piece is dipped and the time it is sent to the assembly floor.

The pickling operation functions automatically, a conveyor system being employed in synchronization with the rest of the equipment. As they come from the press department, the sheet-metal pieces are suspended from hooks, or in baskets, on a series of steel bars about 1½ in. in diameter and about 7 ft. in length. These bars are fastened to a heavy roller chain run on a schedule which permits of thorough pickling of the parts, the speed being 140 ft. per hour. The conveyor and the five pickling tanks are housed in a glass inclosure, which is well ventilated and so arranged that every part of the machinery is readily accessible. Although the speed of the conveyor is constant, the period of immersion of the sheet-metal parts in the various tanks is regulated by the length of the horizontal section of the conveyor immediately above each tank.

After the metal ware is taken from the pickling conveyor, it is immediately dipped and placed on racks, which are hung on an endless monorail conveyor. The metal parts drain while being conveyed into a drying chamber. After being heated to 125 deg. F. and circling back and forth four times, the parts emerge from the chamber and receive a spray of black edge. Immediately thereafter, the conveyor carries the work to the opening of the first furnace. Here the ware is transferred from the conveyor to the revolving hearth.

The usual, muffle-type furnace not being practicable for use in such a system as mentioned above, a type of furnace was developed to possess not only the advantage of fitting into such a system, but also the advantage of reducing the burning operation to a mechanical process.

A slowly revolving structure of steel framework, supporting a bed of firebrick, constitutes the furnace. This is supported within a steel frame about 25 ft. in diameter, lined with firebrick, and incased by steel plates. On the revolving bed of firebrick are placed rows of pins for supporting the various enameled parts. Two openings are located close together at the front of the furnace, one for the placing of ware on the revolving hearth and the other for its removal. The fuel used is electricity. Twelve sets of "Chromel" ribbon heating elements are

Dipping, as shown at the right, takes place immediately after pickling, the parts being hung on the mono-rail conveyor, which carries them to the first drying chamber. Spraying of the first white coat is shown at the left

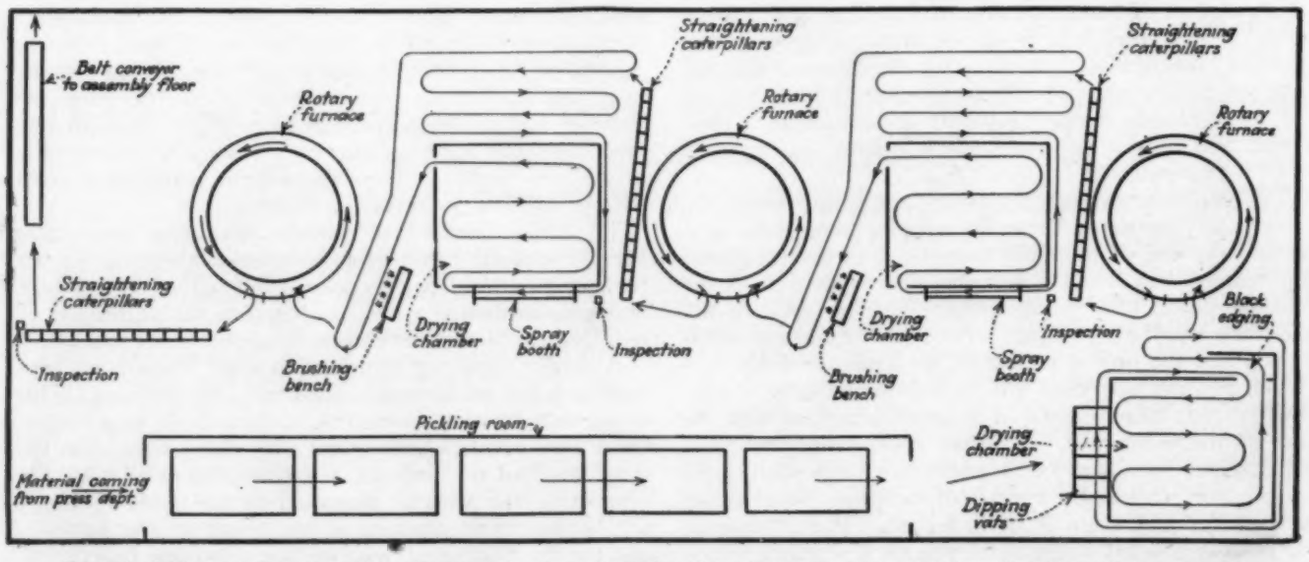
placed horizontally at the rear half of the furnace directly above the path of the ware. The outside diameter of the hearth proper is 175 in., the inside, 113 in. An effective burning area of approximately 14,000 sq.in. is thus provided. The remainder of the hearth constitutes preheating and cooling zones.

Such a type of furnace controls automatically the several factors contributing to the success of the firing process. The length of time of the firing is not controlled by the operator, but by the speed at which the hearth revolves. This speed can be regulated according to the gage of metal being fired, the average time required for one revolution of the hearth being 3½ min. for the finish coats. Another feature is that the temperature is maintained constant at all times by thermostatic control. The particular portion of the furnace that receives the cold ware is cooler than the rear portion, thus eliminating one objection to the muffle-type furnace, the sudden subjecting of the ware to the intense heat necessary to fuse the enamel to the metal base. The work-holding pins are always hot. This eliminates the buckling and warping that is otherwise likely to occur when the pins are allowed to cool between heats. Skilled operators are unnecessary, as the variable factors in the operation of the furnace are all under the control of the shop foreman.

The ware completes one revolution within the furnace, which is at a temperature of about 1,650 deg. F. It is then removed and placed upon a straightening caterpillar. By the time the ware reaches the end of the conveyor, it can be handled easily with asbestos gloves and placed on the next system of mono-rail conveyors equipped with suspended racks. After doubling back and forth over a space about forty feet long, it has cooled sufficiently to permit inspection and spraying. A spray booth is located at a point just before the conveyor enters the second drying room. The ware is again burned, this time at a temperature of about 1,550 deg. F., and is once more inspected. The process is completed by the application of a second coat of porcelain enamel, a third drying and burning, and a final inspection.

Obviously, the old method of placing the ware in racks between operations exposes it to collection of dust and dirt, which impair the finish, whereas the new method permits of no such spoilage. After dipping, no part is rehandled except for spraying and burning.

With inspection made at three points in the successive operations, the set standards are maintained rigidly. The scrap, wash, and resprays have been reduced to as low as 2 per cent on some parts, while the maximum spoilage rarely exceeds 15 per cent. Thus, in comparison with older methods, the losses sustained with this continuous process are low, and the savings high.



Layout of the porcelain enameling department. A part coming from the press room and traveling through the various operations requires 2 hours in process before it goes to the assembly floor. Minimum handling is a feature, and, because of it, spoilage has been greatly reduced

The Art of Hiring Men

Since the labor element in almost any product is at least equal in importance to physical material, the hiring of the right men to do that labor requires genuine intelligence

By K. RANKIN

LABOR is perhaps as much a commodity as any material used in production. While executives watch all other supplies so as to purchase them economically and at the most favorable times, there is little attention given to the most important element of all, namely, labor. A very important matter was touched upon in the editorial, "Re-hiring Old Employees," on page 872, Vol. 70, of the *American Machinist*. The recent prolonged activity in the nation's metal-working plants has served to draw attention, once again, to the importance of skilled workers and the urgency of more careful hiring.

A chain is only as strong as its weakest link, and a production tool is only as productive as the ability or sincerity of the man who operates it. During the past year, the machine-tool builders frequently required from two to four months to make deliveries, and after their machines had been installed, it was almost impossible for the purchasers to find men to operate them, resulting in curtailed production and failure of the machines to do what was expected of them.

There has undoubtedly been a somewhat acute shortage of skilled machinists in many localities, partly because of the rather unusual activity, but more because of the fact that machine-tool builders, as well as other employers, had failed to prepare men for the jobs ahead of them.

It costs money to train men, and many employers hesitate to train them only to have them enticed away by some competitor, or by some local or distant plant under the promise of high wages, or the prospect of a more permanent or more pleasant job. When competition for labor takes place among employers, wages become inflated, the more so as the men become scarcer. Abnormally high wages for skilled machine-operators work to the detriment of the machines they operate. It is, therefore, to the interest of machine-tool builders to be in a position to furnish men that are capable of operating the machines they build. As a matter of self-defence, it behooves the employer, also, to prepare men in times of slackness, that they may be ready to take hold when the need arrives.

When business is brisk, wages high, and the demand for skilled labor i nexcess of the supply, there tends to be more voluntary quitting of employees than when business is poor, since, when work is scarce, men stick to their jobs more closely than when jobs are plentiful and wages high. In the latter case, they are in a better position to pick and choose, and so they drift from one job to another. Normally, unless some special inducement exists, such as high wages, exceptionally good working conditions, future betterment, old-age pensions, or some guaranty of security, good men will move about more or less, while those who just get by will stay on.

Labor turnover is one aspect of employment that deserves careful study. It is at once both a cause and a consequence of employment. No modern plant would attempt to operate without the use of time clocks, time-card systems, etc., to keep tab on labor costs. Piecework and time cards are figured down to the minute and to the cent. Yet turnover is taking a toll of enormous proportions. Some claim that it costs from $10 to $25 to train an unskilled worker, while the cost of training a skilled worker ranges from $25 to $500. When considered from this aspect, labor turnover is a very real item of cost.

The first step toward reducing labor turnover is, of course, to know its percentage, its cause, and how it can be reduced. Labor turnover is an item of expense, and it is very surprising that it is not given as much attention as are other phases of production. Surely, when viewed from this aspect, it assumes an entirely different magnitude, for many concerns have a labor turnover ranging from 30 to 50 per cent.

As the writer sees it, labor turnover may be divided into two classes. In the one instance, it is the result of the voluntary quitting of the employee, and in the other instance, of his dismissal by his employer. Some figures showing reasons for discharge by employers have been given wide prominence. They are reproduced here and represent a study of some 4,375 cases of dismissal.

Inability to do the work	25	per cent
Insubordination	11	" "
Unreliability	10	" "
Absent too often	7	" "
Took things too easy	7	" "
Trouble making	4	" "
Drinking	4	" "
Too slow	4	" "
Physically unadapted to the work	4	" "
Violation of rules	3	" "
Carelessness	3	" "
Miscellaneous, fighting, misconduct	18	" "

It will be noticed that the chief cause for dismissal was that the employee was unable to do the work for which he was hired. The responsibility for this condition rests primarily upon the man who did the hiring. In view of the fact that it costs so much to train workers, it would certainly seem that more real effort and intelligence at the time of hiring would go a long way toward weeding out undesirable applicants for work, thus reducing labor turnover and all its evils.

An intelligent study of voluntary resignations or quittals would be even more valuable, since we know that some good men do quit, while less-worth-while men are always moving about, seeking to better their conditions.

Time devoted to a study of hiring and firing, and to labor turnover and its causes, would be very much worthwhile in many plants. Really good men are often difficult to find, and often too little effort is made to keep them.

Salesmanship

From the Viewpoint of a Purchasing Agent

By CHARLES B. IRMER
Superintendent, Direct Oxidation Process Corporation

DURING the past five years, the writer has been in charge of a small manufacturing plant engaged in the production of a specialized line of machinery. One of his rôles has been that of purchasing agent, and in fulfilling the duties of his office, he has had numerous contacts with salesmen representing the mill supply and allied interests. It has been with great interest that, in the light of a past brief sales training experience, he has studied the method of approach of salesmen, their presentations, and their counter-attacks for overcoming what, to him, were presumably legitimate objections to the articles being offered for sale.

One of the best examples of good salesmanship experienced was demonstrated by the representative of a ball-bearing manufacturer. A design was passing through the drawing room that required the use of several large ball bearings. After the necessary load data and operating conditions had been determined, the information was given to a well-known bearing company, and it presented its recommendations, together with a blueprint showing the preferred method of application. While the design was in progress, it so happened that a salesman representing a competing company called.

As an introductory remark, he pleasantly inquired as to whether there was any need for ball bearings in the particular business in which we were engaged. When advised that, periodically, such a need did exist and that a design was nearing completion at the time for which the bearings had already been selected, he became interested and asked whether there was any objection to his being told the name of the company with which it was contemplated placing the order. When given this information, he replied "That's fine. You could not buy a better bearing." After a little more questioning, he finally determined the competitor's bearing number, and then after referring to his records, said that this particular bearing corresponded to his number so and so; that the competitor's quotation was approximately so much (which was correct); and that he could supply bearings equally as good for a price considerably less.

He showed photographs of installations on machines similar in design to the one on which we were working, and in which the bearings he represented were standard equipment. He successfully overcame objections in reference to the considerable difference in cost for bearings of equal quality. In short, he handled the entire interview in such an exceptionally able manner that he departed with the order in his pocket.

A good example of the other extreme in salesmanship was presented by the local representative of a paint manufacturer. With some of the equipment produced in this plant, paints must be used that will withstand the action of a peculiar and severe condition of corrosion. The standardized paint for this work was arrived at only after lengthy tests of many samples submitted by various manufacturers, and even this standard paint is not all that is to be desired for the work, with the result that efforts are being made constantly to obtain a more suitable product. The salesman in question, when informed of the conditions that the paint must meet, of the paints tested, and the one finally decided upon as being best for the purpose, simply waved his hand and said "That stuff's no good." This, we considered, a fine compliment to the intelligence of our organization, especially after the exhaustive test of elimination previously experienced. When pressed for a sample of his paint for competitive testing with the accepted standard, he simply stated that he did not supply samples as they were never tested anyhow—a further compliment to our organization, this time to its integrity—and that the more suitable procedure would be for us to give him an order for a barrel of his paint and make all the tests desired. He, of course, did not get an order.

As one studies these typical cases, which are but examples of many similar instances that might be cited, the soundness of real fundamental principles of salesmanship will be evident. In the case of the bearing salesman, he first commanded the attention of the prospect by his approach; he enlisted the interest by the commendation of the competitor's product; he created the desire to purchase by showing the economic advantage of buying his bearings; and he procured the final decision and the order by showing photographs of actual installations in which his bearings were performing satisfactorily. The paint salesman, on the other hand, already had the advantage of having his prospect's attention and interest at the time of his approach, but his subsequent actions were such that the contact did not develop any further.

In many circles, scientific salesmanship is classified as "bunk." This condition may be the result either of a lack of knowledge of the principles involved, or to an entire misunderstanding of their purpose. If the conception of such work is that it is supposed to give one the ability to sell anything to anybody, perhaps there is truth in this classification. The designation, however, is far from being correct if the contact covers the handling of a given product with interviews restricted to prospects having a need for such a product. The salesman who knows his product, and who handles his work according to the principles of sound salesmanship, has a considerable advantage over his competitor who does not make use of such practices.

Ordinary belts have limitations and weaknesses, but they are intrinsically few. The knocks which the average belt ordinarily shoulders should be laid to wrong application, inefficient plant housekeeping, ignorance, poor maintenance, and weaknesses of the related mechanism for the service in which it is employed.

IDEAS FROM PRACTICAL MEN

The department, "IDEAS FROM PRACTICAL MEN," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

A Seven-Stage Progressive Die

BY GEORGE T. KERR

A progressive die for the first series of operations in making felt retainers is in daily use. The material used is dead-soft drawing stock in long strips, $\frac{1}{16}$ in. thick, the stock being fed to the dies by feeding rolls

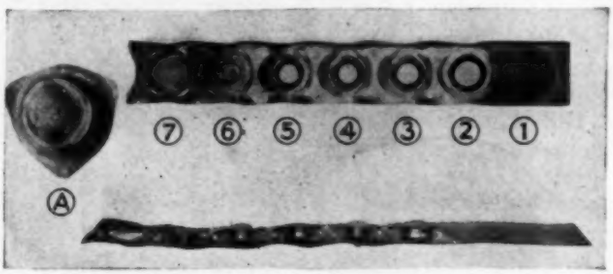


Fig. 1—The work done by the progressive die

actuated by a cam on the crankshaft of the press.

The appearance of the piece at each of the seven operations is shown in Fig. 1. At *A* is an enlarged view of the piece after it has been cut from the strip by the seventh die.

In the first die, a circular piece is partially blanked from the strip, $\frac{1}{2}$ in. on opposite edges being left uncut, so that it will be carried through the other dies with the strip. In the second die, the first draw is made, with re-drawing in the third, fourth, and fifth dies. In the sixth die, the radii at the top and bottom are finish-formed, and the flange is flattened. In the last die, the retainer is completely blanked from the strip, passing through the die and out at the end of the die shoe. In Fig. 2 the die is shown in the press.

Several other press operations are necessary to complete the piece, all being performed in simple dies that need no description.

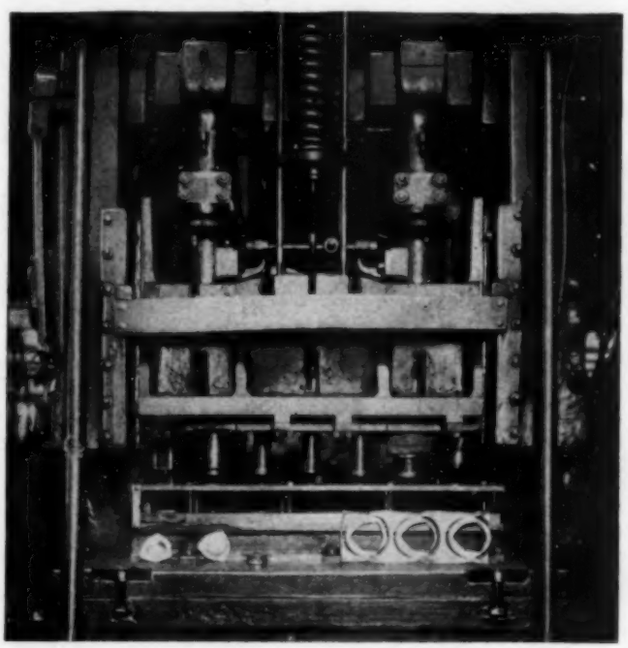
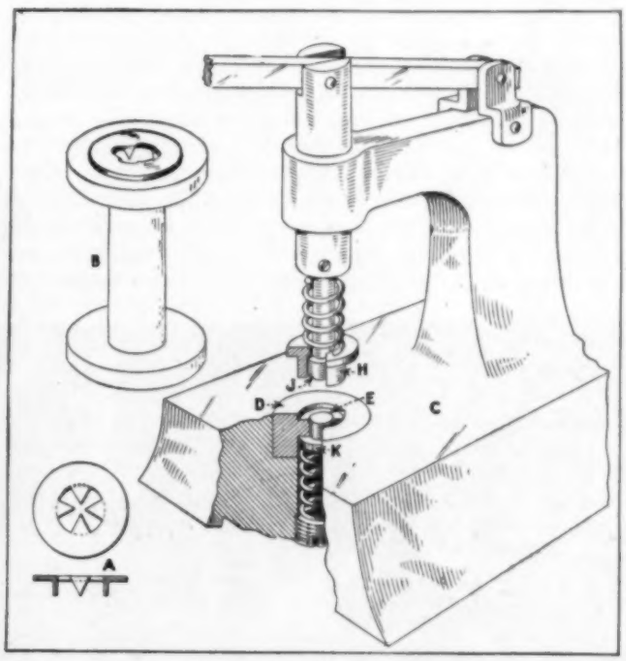


Fig. 2—The die in the press

A Simple Bending Fixture

BY CHARLES H. WILLEY
Asst. Plant Supt., Hoyt Electrical Works

We use many thousands of small terminal washers as shown at *A*, each having four sharp prongs. The washers are made from 0.025-in. semi-hard brass and are used as soldering terminals around the central holes



Tools for forming pronged washers

of wooden resistance-wire spools, such as the one shown at *B*. The prongs are embedded in the wood to hold the washers in place.

The washers are blanked from roll strip in a hand press and are formed in another hand press by the very

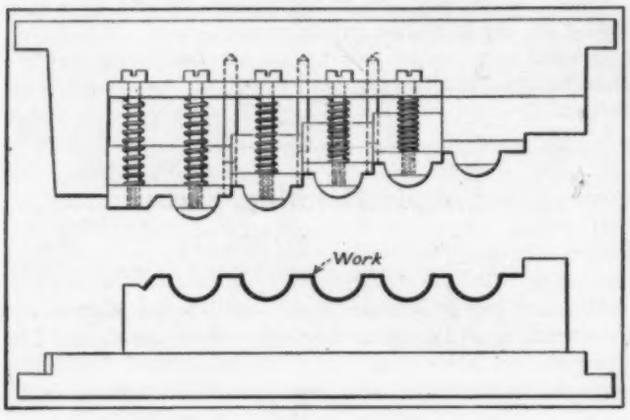
simple tools shown in section at *D*. Each washer is put into the nest *E*, and, as the plunger descends, the pressure ring *H* strikes it and holds it while the punch *J* passes through, pushing out the prongs and forcing down the ejector *K*. As the plunger is raised, the ejector throws the completed washer out of the nest. The die is level with the press bed, allowing the completed washers to be brushed away. The production is 1,200 per hour by a girl operator.

Progressive Forming Punch and Die

By Ernest Foldvary

In the illustration is shown a set of press tools of rather peculiar type. The parts to be processed in these tools are made from thin strips, 1 in. in width.

The die is a solid block corrugated to the shape required by the parts. A solid punch would make all the



Press tools for progressive forming

corrugations in the parts simultaneously, stretching the metal beyond all reason, and probably tearing it. Therefore, the punch is made in sections that slide in the punch holder, so as to make the corrugations in the parts in rotation, but at one stroke of the ram. Each section, except the one at the right, is backed up by a spring that is stiff enough to resist the pressure required to bend the material. The operation will readily be understood after a cursory examination of the sketch.

Air-Operated Tools in a Railroad Shop

By R. E. Marks

Ever since the introduction of the air brake, railroads have found numerous uses for compressed air in the shops and round-houses. Parts of standard air-brake equipment lend themselves readily for use in many devices, such as shown in Figs. 1 and 2, where both large and small brake cylinders form the power units of the machines in which they are used in the Santa Fe shops.

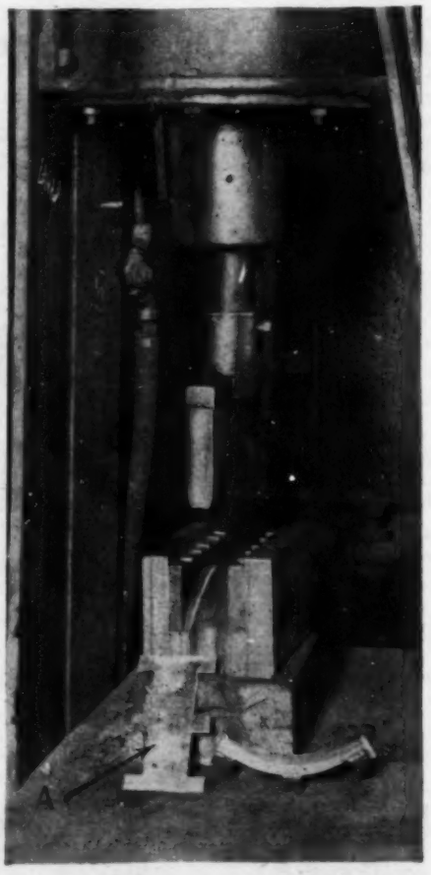


Fig. 1—Utilizing a brake cylinder for shaping sheet metal parts

In Fig. 1 the cylinder is simply mounted on two vertical steel bars over a suitable plate or anvil, and the whole is tied together by braces on the outside. The machine is shown shaping unit cinder guards for superheaters, and it has many other uses. These guards are first blanked out from a sheet, as at *A*, and laid in the notches at the top of the die. A stroke of the press turns up the six ears and forms the groove in the bottom

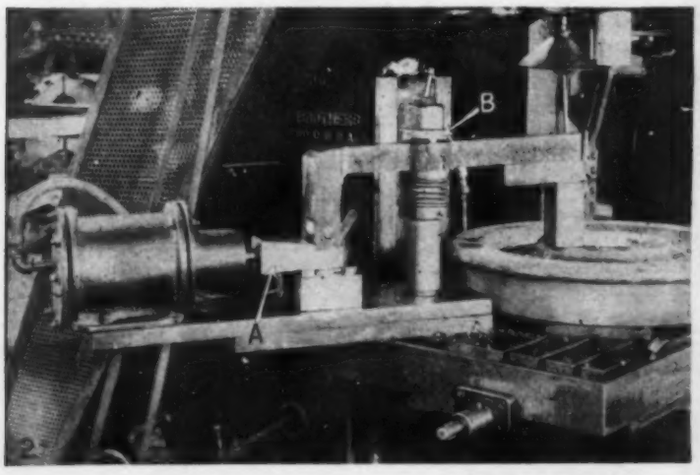


Fig. 2—An air clamp that can be used on a number of machines.

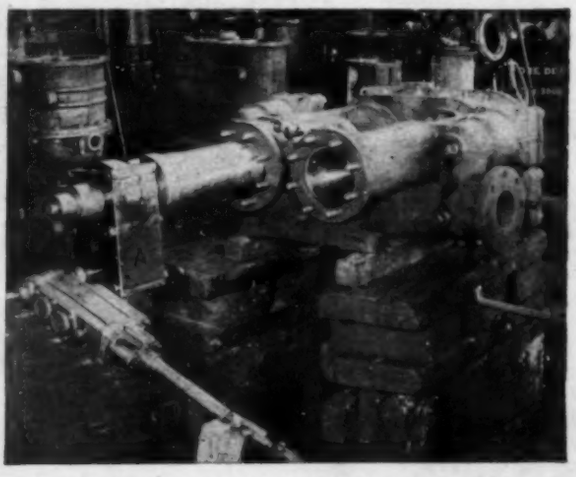


Fig. 3—Using an air drill, through a reduction gear box, to pull liners into feed pumps

while shaping the whole thing to the proper radius.

Fastening a smaller air cylinder to the end of a steel slab and mounting a wedge, *A*, Fig. 2, on the end of the piston rod, gives the power needed to operate the clamp shown for a variety of uses. A roller over the wedge in the holding-down arm, reduces friction in operation. The fulcrum is formed on the under side of the washer, as at *B*. Fastened to the table of a machine as shown, this device enables work to be quickly clamped for any operation without the necessity of tightening several bolts.

Gear reductions for using air drills as a motive power are frequently used. In Fig. 3 is an application of such a device to the job of pulling in bushings in a feed water heater pump. Through the gear reduction, inclosed in the rectangular box, *A*, the motor turns a nut on the long screw and forces the bushing into place.

Clamp for Splicing Cable-Eyes

By C. F. Henry

Splicing a rope or cable is more or less of a mystery to the shop man who has never done it. The wide use of small wire cables in airplane construction and repair makes it advisable for the average mechanic to know something about splicing. Fig. 1 shows a small eye being made with the sheet-metal thimble inside. The cable is held on the thimble by the clamp in the man's left hand.

Fig. 1—Splicing a thimble into a cable eye

In Fig. 2 details of this clamp are shown more clearly.

With the cable held firmly in place around the thimble, as illustrated, the strands of the cable are pried apart by an awl-like instrument in the right hand, leaving openings into which the ends of the cable are woven so as to conform with the way in which the cable is laid up. Long practice enables a man to weave the ends into the openings so that they seem a part of the cable itself.

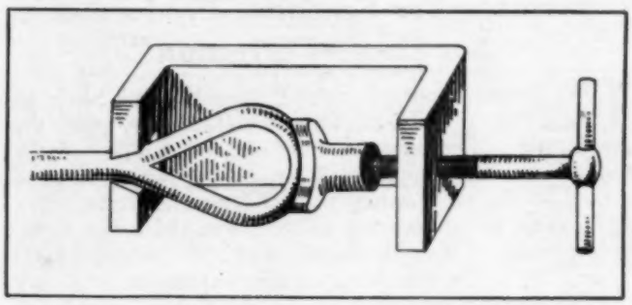
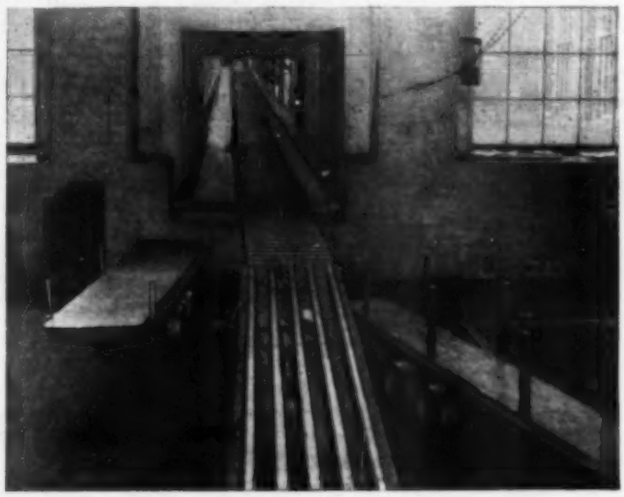


Fig. 2—Clamp used to hold cable in splicing

Handling Bar Stock and Sheet Metal

By J. S. Browne

At a large manufacturing plant, where the raw stock storeroom is located in the center of a group of buildings at some distance from the railroad siding, a gravity roller conveyor is employed, as shown in the illustration,



Conveyor for Handling Bar Stock and Sheet Metal

for transporting the bundles of bar stock and boxes of sheet metal from the cars to the storeroom. The conveyor runs in an inclosed structure leading from the car siding into the building. It has a slight pitch sufficient to keep the stock in motion and to enable it to travel under its own weight to the discharge end.

The bundles of bars and boxes of sheet metal are discharged onto a slide consisting of five long bars supported on a wooden framework. From this slide they are taken and stacked on hand-operated trucks for removal to storage racks. Two of these trucks are shown in the photograph.

A Gib-Key Puller—*Discussion*

By Gilbert B. Coombs

I recently had occasion to pull out a very tight key, and decided to try out the puller described by Carl M. Dinger on page 799, Vol. 70, of the *American Machinist*. The tool was an unqualified success and saved me the trouble and expense of drilling out the key.

In his discussion, on page 674, Vol. 71, J. T. Towlson raises some objections to the device, which I believe can easily be overcome. If the loop shows a tendency to slip from the head of the key, it may be secured by a small C-clamp. If the key is a large one with plenty of stock in the head, the difficulty of insufficient room for the loop may be overcome by undercutting the inside of the key head. The material so removed may be replaced by welding after the key has been drawn. A heavy hammer held under the head will eliminate the danger

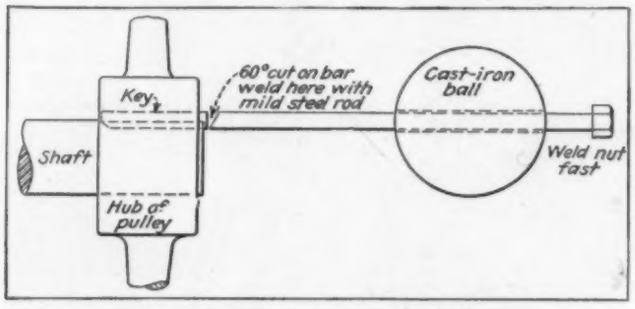
of bending the key while driving it out by the weight.

If the above suggestions do not meet the case, or if the key head has been broken off, it may be preferable to drill the key for a short distance and tap the hole to receive a long stud. This stud will take the place of the rod and loop, and the weight can be used on it with excellent results.

A Gib-Key Puller—*Discussion*

By Carl M. Dinger

In reply to J. T. Towlson's article under the title given above, on page 674, Vol. 71, of the *American Machinist*, I agree with Mr. Towlson that if the key has been driven up to the head, or nearly so, it will be impossible to get



Modification of the original device

the loop of the device over the head. To overcome this difficulty, I have modified the device, as shown in the accompanying illustration.

By using a plain rod having a nut welded onto the outer end and the inner end acetylene-welded to the head of the key, the key easily can be pulled. If the head is broken off, or if a plain key has been used, the rod can be welded to the body of the key. After the key has been pulled, it can be sawed from the rod.

A Safety Kink for Storing Plates

By H. P. Leonard

Several interesting features are incorporated in a rack, shown in the illustration, for storing steel plate in the tank shop of the Chicago & North Western Railway Company. One of the principal features is the safety device shown, used to prevent plates from falling off the rack and endangering workmen. Essentially, the device is a hooked link pivoted to the central section of the rack through a common bolt. In order to remove a plate it is necessary, of course, for the workman to lift the link clear of the stored plates.

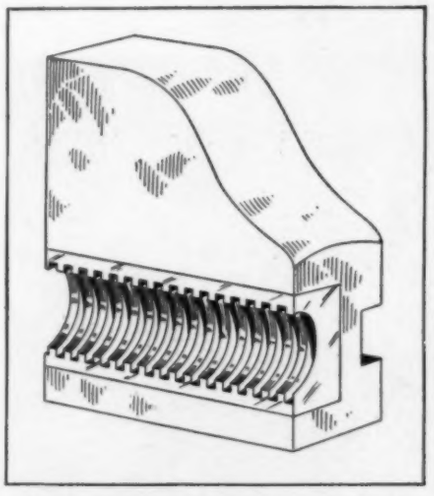
The rack itself is simple and effective in design. It is made from $\frac{3}{8}$-in. scrap plate cut to the shape shown by the torch, and the three sections are held together with three $\frac{7}{8}$-in. tie rods and $1\frac{1}{4}$-in. pipe spacers. In the illustration the plate shown is $\frac{1}{4}$ in. thick and 36 in. wide. The safety link was forged from $2 \times \frac{3}{4}$-in. strap iron and measures 17 in. inside the U-shaped opening. The hook is about 5 in. depth.

Safety kink used on storage rack for plates

Repairing a Chuck

By N. Kaufmann
Chas. Kaufmann & Sons

We have a two-jawed chuck in which the threads had become stripped from one of the jaws and from the mating end of the screw. Upon inquiry, we found that new parts, including carrying charges, would cost more than we thought they were worth. So we decided to recondition the chuck ourselves, and proceeded in the following manner: First, we made a new screw. Then we made a nut from a piece of square steel. After the threads had been chased to fit the mating end of the screw, the nut was cut in two, lengthwise. Next, we cut a channel $1\frac{1}{2}$ in. wide and $\frac{3}{4}$ in. deep in the side of the jaw, cutting out the old threads, as shown in the illustration. After planing the half-nut to fit the channel cut in the jaw, it was brazed in place. The whole job was completed in five hours, and the chuck has given very satisfactory service.



Chuck jaw with half-nut brazed in place

Formulas for Economic Production Lot Sizes—*Correction*

TWO errors occurred in the Reference-Book Sheet on page 749, Vol. 71, of *American Machinist*, under the above title. The first occurred in the middle of the denominator of Equation 2, in the upper right-hand corner of the page, where: $S \cdot t \cdot 1$ should read $S \cdot t \cdot i$. The second error occurred in Item 4 in the lower right-hand corner. This item should read: "4. Subtract k_p/D from $1/S$." The last letter of this expression is S, not s. These errors occurred also in the S.A.E. production meeting paper from which the formulas were taken.

Efficiency of a Welded Joint

EFFICIENCIES of some of the principal welded joints are shown in the accompanying table. The following explanatory notes are given:

1. The efficiencies compare the strength of joints in plates of thickness t with the plates when butt welded, but without reinforcement.

2. The efficiencies refer to joints of the same width as the plate.

3. With fillet welds, the efficiencies apply when the fillets have an approximately straight contour, lying at 45 deg. with the surface of the plate. They also apply to other contours as long as the throat thickness is not less than 0.69 t.

4. A joint may be made stronger readily than the body of the plate away from the joint.

5. The figures given refer to static tensile test, and it does not follow that the behavior of joints in service will be in proportion.

6. The strengths quoted apply only when the load is applied in the directions indicated.

In the table, t is plate thickness, l is length of lap, and b is original plate thickness in a transverse lap.

FORM OF JOINT	EFFICIENCY	REMARKS
Non-Reinforced Butt Weld.	100%	
Lap Weld with Single Fillet (Subjected to Bending)	50%	Up to ¼" plate for circular seams. Quite unsuited for longitudinal seams of pressure vessels.
Single Butt Strap (Of the same thickness as the plate)	50%	Ditto
Lap Weld (No Bending)	60%	
Lap Weld with Two Fillets (Subjected to Bending)	100%	l not less than $3t$. Only suitable for longitudinal seams of pressure vessels when t does not exceed ⅜"
Half-Lap Joint with Two Fillets (No Bending) (Of the same thickness as the plate)	120%	
Double Butt Straps (Of the same thickness as the plate)	120%	
Joggled Lap Joint	133%	l not less than $2t$. Only suitable for longitudinal seams of pressure vessels when t does not exceed ⅜"
Joggled Lap Joint	133%	Ditto
Butt Weld with Single Strap of Half the Plate Thickness		An unsatisfactory form of joint. Bending stresses are introduced and complex stresses set up at the fillet welds, with the result that the strap only increases the strength of the joint inappreciably above that of a plain butt weld
Butt Weld with Single Strap of Full Plate Thickness (Of the same thickness as the plate)	Say 120%	An unsatisfactory form of joint not recommended for pressure vessels
Butt Weld with Double Straps of Half the Plate Thickness	160%	
Special Form of Lap Joint. Weld Metal in Shear	80%	Eff. = Strength in shear / do in tension. Owing to the difficulty in making a weld of the form shown, the efficiency should be taken not higher than 80%
Transverse Cover Straps, Welded at the Sides Only		The strength depends on the form of fillet and in general fracture takes place at the place indicated below
Double Straps of Half the Plate Thickness, Opposite One Another (Fracture)	90%	The strength of the weld per unit length is 75% that of a lap weld at the end of the strap
Single Strap of Full Plate Thickness	75%	
Single Strap of Half the Plate Thickness	45%	The result is relatively higher than before, owing to the strap receiving greater support against bending
Transverse Cover Straps Welded at All Sides		
Double Straps of Half the Plate Thickness, Opposite One Another	150%	
Single Strap of Full Plate Thickness	125%	
Welded Flanges		
Branches and Other Fittings Affixed by a Fillet Weld		Efficiency apply when fillets have an approximately straight contour, lying at 45 degrees with the surface of the plate

Condensed from a technical report by Harry M. Longridge, Managing Engineer, British Engine Boiler & Electric Company

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American Machinist

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Two Reasons for Placing Orders Now

THERE is an old saying to the effect that he who gives promptly gives twice. It applies exactly to the man or the company now in a position to place orders for equipment or materials. Immediate action means that the suppliers of both equipment and materials will be able to continue operations at a rate that will prevent layoffs and unemployment.

During the first quarter of the year unemployment is attended by the greatest hardship. And after the first quarter of 1930 it is highly improbable that unemployment will present much of a problem. Orders placed at once, therefore, will be doubly effective in preventing suffering.

But there is another side to the picture. Equipment builders are still working on unfilled orders and will be so occupied for some weeks to come. Consequently, orders that are held back now may accumulate to form an avalanche that will bury the equipment companies later on, and result in delays and annoyance for the buyers. Such congestion might very well bring on a most undesirable boom, and possibly increase prices. There could hardly be a worse time to indulge in the kind of "wait-and-see" conservatism that has wrecked many companies in the past. Those who wait usually see only the backs of their more courageous competitors, and those backs are going away from them at a good, fast clip.

*

Banker or Pawnbroker

DURING the high money period that prevailed throughout the fourteen months beginning August, 1928, many a manufacturer has been in unfavorable position to consider or to disturb his banking connections. If his operating necessities were covered at current interest rates, he could well congratulate himself. And if his account were in the hands of a banker so farsighted as to lend him funds at legal rates for new machine-tools, new buildings, and other needed capital investments, he could justifiably follow the precedent of Roman emperors who erected triumphal arches to themselves after great military victories.

Though many bankers preserved the finest traditions of constructive banking, it is common knowledge that many did not. Some indeed, who would shudder piously at a suggestion of pawnbroking, descended below the level of forthright pawnbrokers. Pleading "tight money" to their legitimate customers, they called sound loans, refused new funds for legitimate purposes, and shoveled millions, indirectly and directly, into market gambling.

Now is the time for all manufacturers to analyze their markets, their manufacturing facilities, their sales organizations, their financial structures, and their banking connections. Since "easy money" should become more and more the rule during the coming months, the farseeing business man will not forget to determine whether his banker is a genuine banker or a glorified pawnbroker. If the former, he will make every effort to consolidate his fortunate association; if the latter, he will quietly seek out a genuine banker and just as quietly change his affiliation.

*

Work

AMERICAN business men who have had the pleasure of entertaining visitors from England and the Continent, and the privilege of explaining and demonstrating American business methods, have probably had the gratification of hearing expressions of amazement at the way in which American executives attack their tasks. American executives work longer hours, as a rule, than do their contemporaries elsewhere, and most of them are rather more intense about their jobs while they are at it. But are long hours and intensity of application always synonymous with efficiency and accomplishment?

President Hoover, with Lincolnian simplicity and homely directness, has told American business that the quickest way out of its troubles is to stop talking, forget speculating, and go to work.

If the amazement of our European guests at our ability to work is really justified, now is our chance to prove it. Extracting the teeth of the business cycle is no sinecure for anyone. Work, and work alone, can do it.

SHOP EQUIPMENT NEWS

Cincinnati No. 3-24 Plain and Duplex "Hydromatic" Milling Machines

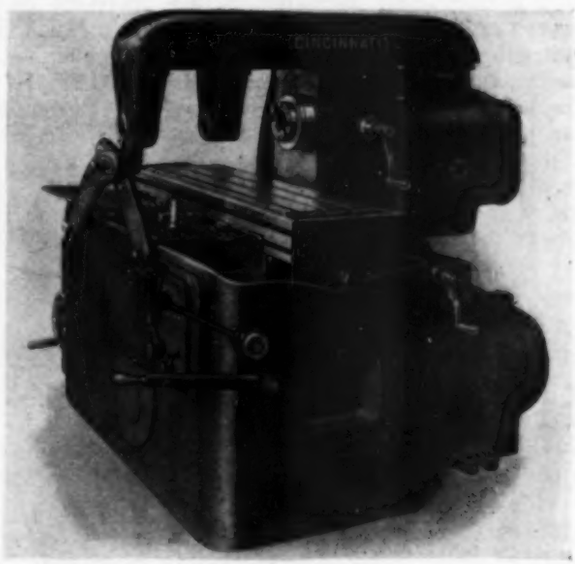
MOST production milling jobs can be handled satisfactorily on the No. 3-24 plain or duplex "Hydromatic" milling machines, according to the Cincinnati Milling Machine Company, Cincinnati, Ohio. These machines are built with locked hydraulic table feed.

The principal units of the plain machine are the standard No. 3 bed table unit with a 24-in. table travel, the standard No. 3 headstock unit, the standard No. 3 spindle carrier with overarm and two arbor supports, the spindle reverse and clutch unit, and the hydraulic feed unit located at the rear of the fixed bed. This machine as well as the Duplex model is built on the "Cincinnati" plan of standard unit construction, which makes it possible to supply them with widened and raised headstocks, close-coupled spindle carriers, a variable height overhung rail, and a bridge-type fixed rail.

The work table is mounted on a solid, semi-steel bed, having unusually long bearings. In construction the bed is heavily ribbed and provided with pockets which allow a large volume of cutting coolant and chips to fall directly inside. It is designed so that splash guards can be applied readily to confine the coolant within the table area. The spindle carrier unit and the spindle reverse and clutch unit comprise the entire spindle drive. A multiple-disk friction clutch and bevel gear reverse mechanism are contained in the spindle reverse unit.

The spindle carrier is a self-contained unit, in which the whole gear transmission is mounted, including the spindle speed change gears. Eight standard spindle speeds are available, ranging from 27 to 200 r.p.m. High- and low-series, spindle-speed, change gears can be supplied on special order. The spindle is carried in a heat-treated 7-in. steel quill, which has a cross adjustment of 4¼ in. through a self-locking worm and rack operated by a crank. Other adjustments for setting up the machine, such as raising and lowering the spindle carrier, are made from one position at the right of the machine. All bolts for loosening and tightening the various units can be adjusted from one position, a valuable time-saving feature.

A quill in the spindle carrier is clamped regularly around its full circumference. On top of the spindle carrier is mounted the standard rectangular overarm, which has means for self-alignment, ease of longitudinal adjustment, and means for quick mounting of the overarm supports. Overarm braces supported from the lower end of the outer arbor support, and fastened to the sides of the bed, are offered on this machine. The double mounting of anti-friction bearings, both front and rear, on the spindle is retained. All gears are of alloy steel and heat-treated. The face gear is 11 in. in diameter by 1¾ in. in face width. The spindle drive mechanism rolls on anti-friction bearings and is lubricated automatically.



Cincinnati No. 3-24 "Hydromatic" Milling Machine

The locked hydraulic feed unit, consisting of a variable-displacement metering pump, a small, simple booster pump, a gear pump, and the necessary control valves, forms the closing member of the rear end of the machine bed. There is very little external piping. This unit is the same as that of the larger sizes, and is standardized so that it is completely interchangeable. Hand feed changes are made by shifting the single lever located on the feed unit. Any desired feed between 0 and 40 in. per minute can be obtained very easily.

Automatic variable feed to suit a varying width or depth of cut can be obtained through the use of the variable-feed attachment, which is fastened to the bed to the right of the hydraulic feed unit and adjacent to the head. This attachment is supplied on special order. A simple cam or template to suit the job is located on the side of the table. It actuates a plunger that, in turn, controls the hydraulic mechanism that determines the rate of table travel from 0 to the maximum rate. Likewise, a positive stop and delayed trip attachment, for feeding to a definite depth and dwelling to clean up the cut, is supplied on special order.

All operating levers are located conveniently at the normal operating position. The lower lever, known as the spindle drive starting lever, is used for starting and stopping the spindle. A second lever just above it, known as the table-feed, directional-control lever, has four positions. The nature of these positions depends upon whether the machine is of a one-way or of a two-way cycle. The one-way cycle machine has feed to the left and quick traverse left and right. Therefore, there is one position for feed, two for power quick traverse of 300 in. per minute, and

another one known as the stop position. The position of the lever indicates the direction in which the table moves. Two-way cycle machines have two positions for feed and two for power quick traverse. Plain machines are supplied with one-way or two-way feed cycles, while the Duplex machines are offered only with the one-way cycle. A third lever, known as the table stop lever, located at the side of the bed, starts and stops the table movement without affecting the table cycle.

Automatic control of all table movements, including the automatic intermittent feeds of the table, are obtained by dogs. Reversal time of any milling cycle has been considerably reduced, permitting the use of shorter feeding strokes and giving faster production. A large variety of milling cycles, whether the machine is the one-way or two-way cycle type, can be obtained. One-way cycle machines only have an automatic spindle stop for stopping the cutter and spindle at the completion of the cut just before the rapid return of the table. The small lever to the right of the table stop lever is the automatic spindle stop engaging lever.

The pulley bracket and reverse box unit are oiled automatically by splash, while the spindle carrier unit is lubricated automatically by a pump. One-shot lubrication is provided for the chain drive unit of the hydraulic feeding mechanism, the clutch vertical drive, the bearing in the reverse box, the feed trip plunger, and the table ways. A flood coolant system to supply 20 gal. per minute of coolant to the cutter can be furnished on the customer's order.

The machine described above has a working table with over-all dimensions of 49x12 in., and with a total travel of 24 in. The net weight of the No. 3-24 plain machine is 5,500 lb., and of the duplex machine, 6,500 lb. In addition, these machines can be supplied with a 30-in. table travel, when they are known as the 3-30 plain or duplex Hydromatics. The net weight of the 3-30 plain machine is 7,500 lb., and the duplex machine, 9,000 pounds.

Diamond Face Grinding Machine

HYDRAULIC drive is featured in the face grinding machine shown in Fig. 1, a development of the Diamond Machine Company, Providence, R. I. All controls are centralized at the operator's position, as shown in Fig. 2. In this view are shown the location of the hand and automatic wheel feeds, the valve regulating the speed of the table, and the lever and table dogs controlling the motion of the table and the length of travel. The location of the valve controlling the speed of the table makes it a simple matter for the operator to adjust the table speed to suit the type of grinding being done.

The specifications herein described cover the 30- and 36-in. machines only. Other capacities can be furnished upon request. The beds of these machines are 176 in. long, have a 90-deg. V-way in front, $3\frac{1}{2}$ in. wide, and a flat way in the rear, $4\frac{1}{2}$ in. wide. A 30-in. spread is given to the column, which has two, flat, 6-in. ways.

The size of the table is 24 by 200 in. in over-all length, the platen measuring 24x86 in. and having five T-slots for $\frac{3}{4}$-in. bolts on $4\frac{7}{8}$-in. centers. Drive is by means of a low-pressure hydraulic cylinder and a piston, to which power is furnished by a $7\frac{1}{2}$-hp., 900-r.p.m., motor and heavy-duty oil pump. The 30-in. machine will take work 20 in. high by 84 in. long, whereas the 36-in. grinder will take work 24 in. high by 84 in. long. An additional four inches of height can be machined if the front guard plate is removed. Extra length tables can be furnished.

A "Diamond," patented, segmental-type, wheel chuck is used, the segments being $7\frac{1}{4}$ in. deep by 2 or 3 in. wide. The 30-in. machine has a chuck carrying twelve of these segments, and the 36-in. machine fifteen. Over 6 in. of depth adjustment for wheel wear can be obtained. Truing is done by means of a permanent star-wheel attachment. Wheel feed is obtained either by hand or automatically for a total of $2\frac{5}{8}$ in. The automatic feed ranges from 0.001 to 0.01 in., and hand operation gives a maximum feed of $\frac{1}{16}$ in. per revolution of the handwheel. Power is furnished to the wheel by means of a 40-hp., 40-deg. temperature rise, 1,200-r.p.m. motor through a $\frac{3}{4}$-in. pitch, silent chain 7 in. wide.

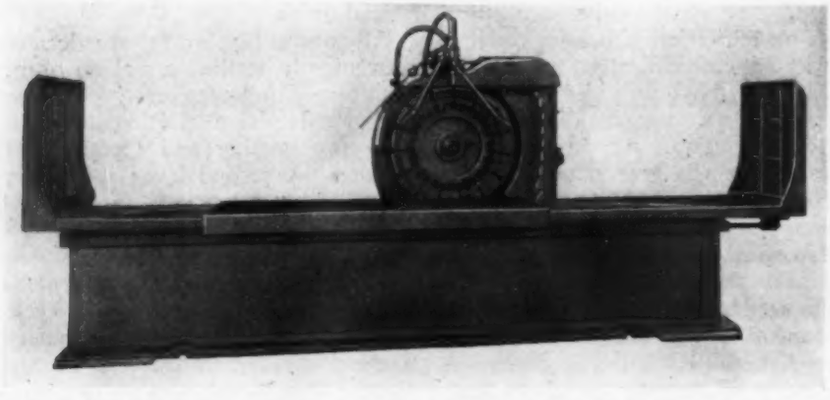


Fig. 1—Front view of the Diamond Face Grinding Machine, which is available in 30- and 36-in. standard sizes

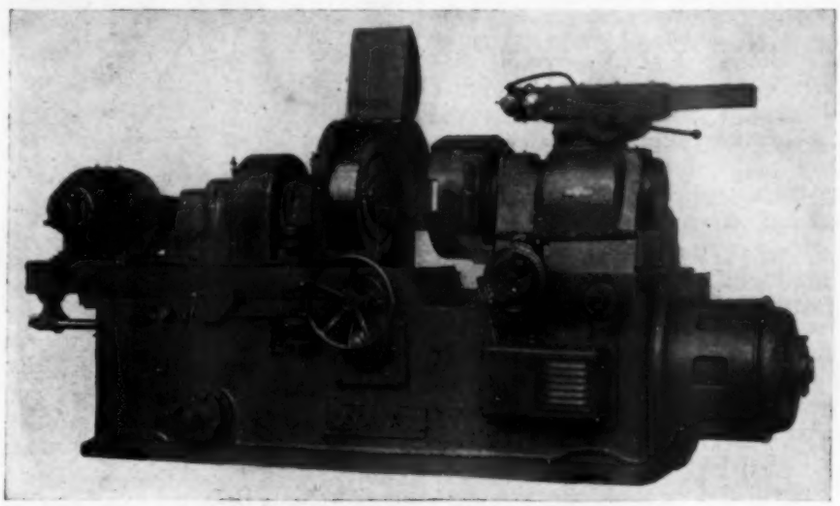
Fig. 2—View from the left end, showing the control mechanisms grouped together at the drive compartment

A coolant tank integral with base has a capacity of 84 gal. and is furnished with a sediment tank that is supported on a hinged door and swings out for cleaning. A vertical spindle pump is employed. It is direct-connected to the motor. Two specially designed discharge openings furnish the coolant to the nozzles.

Floor space requirements are as follows: 7 ft. 6 in., front to back; 26 ft. 6 in., end to end. The weight for the 30-in. machine, without motor, is 15,500 lb. and for the 36-in. machine, without motor, 17,000 lb. The motor weighs 2,100 pounds.

Cincinnati Improved Brake Drum Grinder

THE "Cincinnati" brake drum grinder now being offered by Cincinnati Grinders Incorporated, Cincinnati, Ohio, embodies several improved features. More safety for the operator is provided by the fully guarded grinding wheel. The guard is of cast steel and is removable. A slip-off cover on the top of the guard allows easy access to the grinding wheel for truing.



Cincinnati Brake Drum Grinder, front view

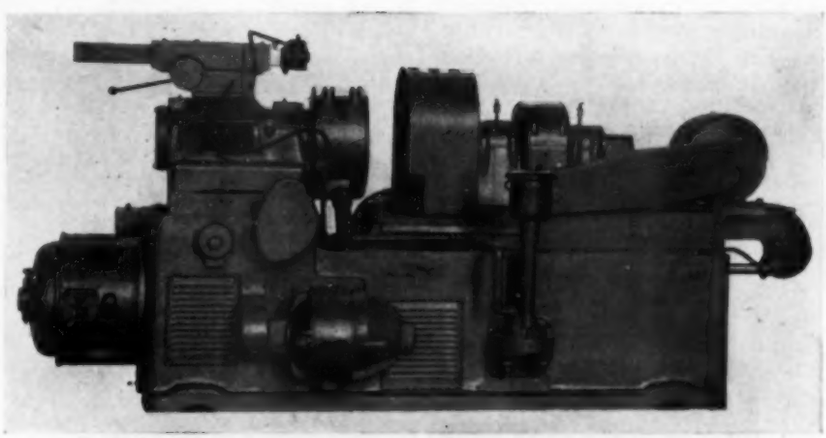
The mounting of the precision grinding wheel spindle on anti-friction bearings is another improvement. To bring the grinding wheel into the work the required distance, an independent in-feed attachment driven by a fractional-horsepower motor is provided. This improvement allows the grinding wheel to be fed into the work either by hand or power. A dead stop is provided, arranged for use with either the power or hand in-feed. Sizing by means of the dead stop is sometimes facilitated by a dial gage permanently located in contact with the ground surface. A micrometer indexing mechanism is also provided for close setting.

The grinding wheel truing equipment is mounted on the top of the wheelhead and is operated by a hand lever. By removing the slip-off cover on the wheel guard, the Ross type dresser is quickly brought into position for truing the grinding wheel. An independent valve supplies a stream of coolant for wheel dressing.

An improved motor-driven vertical coolant pump is located at the rear of the machine. Since the rotor of the pump is located below the level of the coolant supply tank, the necessity of priming is eliminated. By mounting the pump outside the machine base, servicing is made easy.

This grinder has a capacity to swing work up to 26 in. in external diameter, thereby permitting not only the mounting of unmounted drums but also wheel and drum assemblies. Inside diameters up to 22 in. can be ground on mounted drums. A 21½-in., rotary, magnetic chuck with a hardened and ground steel centering plate is supplied for holding the work firmly. Reciprocation of the work over a short stroke, while the grinding wheel is fed automatically into the work, keeps the ground surface free from wheel marks and insures smooth braking surface for the drum. Control of this movement is by means of a valve. This mechanism embodies a cam-operated reciprocator driven from the headstock work spindle. In addition to keeping wheel marks out of the work, the reciprocating motion decreases the number of truings required for the wheel and reduces manual labor for the operator. To facilitate loading and unloading, the travel of the workhead is air-controlled from a small valve conveniently placed near the operator's left hand.

This grinder is operated on the plunge cut principle. The increased capacity saves much time and also makes grinding from the rough an economy in some instances. Since the grinding wheel is within approximately 2 in. of the diameter of the inside braking surface to be ground, a soft-face cutting wheel can be used.



Cincinnati Brake Drum Grinder, rear view

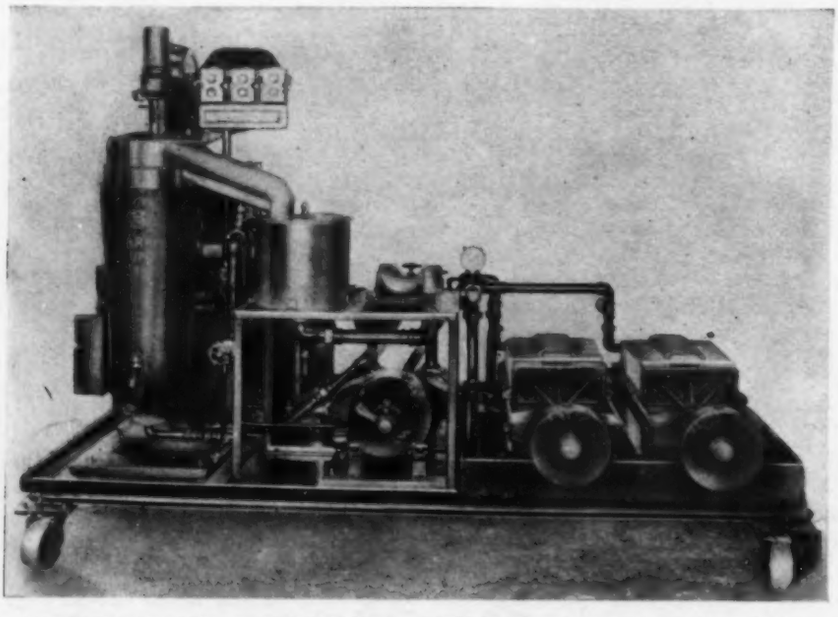
The machine is entirely self-con-

tained, the grinding wheel being driven by a 40-hp. motor built into the machine, and the workhead is powered by a 5-hp., variable-speed, d.c. motor. A generator, mounted on the bed, supplies 230-volt, d.c. power to the headstock motor. A rheostat, located within reach of the operator, controls the various feeds of the work. The workhead motor is equipped with a dynamic brake to stop the work instantly. The third motor, which supplies the power infeed to the wheelhead, is mounted on the front of the machine.

Westinghouse Sharples Super-Centrifuge and Filter Press Oil Purifier

Claimed to be the largest portable combination centrifuge and filter press on the market, the combination Sharples super-centrifuge and Westinghouse filter press oil purifier, is being offered through the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The first unit is made by the Sharples Specialty Company, 23rd & Westmoreland Sts., Philadelphia, Pa. It is the Sharples super-centrifuge combined with a Westinghouse filter press and mounted on a truck.

The following advantages are claimed for the equipment: Thoroughly cleans 1,200 gal. of oil per hour; purification is complete in one operation; operation is simple and clean; practically no oil is lost in handling; construction is sturdy and simple; maintenance is low; floor space occupied is only 54 in. by 106 in., and it can be easily moved from place to place.

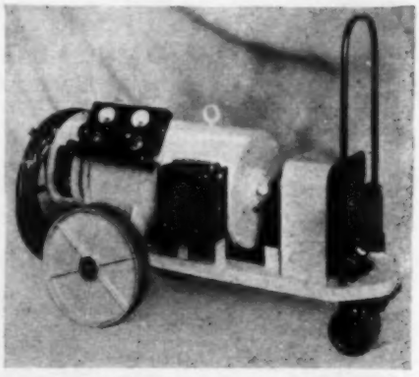


Combination Sharples Super-Centrifuge and Westinghouse Filter Press Oil Purifier

"Carb-O-Flux" Arc Welding Generator

TO SUPPLY current for the "Carb-O-Flux" arc welding process, which is a combination of a carbon welding arc and a fluxed wire or rod, the generator illustrated has been placed on the market by the Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill. The process is applicable to mild steels, aluminum, copper, and some alloy steels. The characteristic difference between this process and that of straight carbon arc is that the Carb-O-Flux arc, when applied to steel, pulls off from the hottest spot on the deposited metal, whereas the straight carbon arc tends to seek the colder edges. It is claimed that although there is ordinarily a 40-volt drop across the regular carbon arc, there is only a 20-volt drop across this arc, which necessitates the liberation of less heat. The tendency to burn through on thin sheets of any metal is therefore reduced.

It is necessary for the welder to wear a face mask when using this process. A very steady hand is also a requisite for successful welding, and, on this account, women operators have been found quite adaptable.



"Carbo-O-Flux" Welding Generator

On the heavier sections it is claimed that the Carb-O-Flux process will cut down the welding time to about one-third, while on the lighter materials the welding time can be cut in two. In addition, the welding cost can be cut from 25 to 75 per cent, depending upon the job. It is especially suitable for aluminum sheet welding, for which, it is claimed, joint efficiencies of 100 per cent can be obtained practically all the time. The welds are strong and also ductile. Sheet steel can be crimped crosswise of the head of such welds without cracking, and the welds in steel will also take enameling readily.

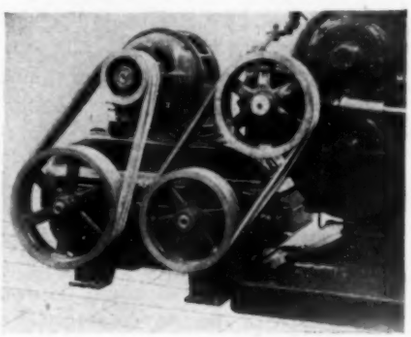
The Carb-O-Flux electric generator is available for a.c., three-phase, 60-cycle, 220- or 440-volt circuits, but it can be furnished for other drives, such as belt drive from the line shaft, d.c. operation, and also a.c. operation from 25- and 50-cycle circuits, as well as for two-phase circuits. Direct gas-engine drive can also be supplied. All of these, except the three-phase 60-cycle drive, are special and must be built to order.

The accessories consist of a cable with proper lugs for attaching an electrode holder, a ground clamp, and a helmet equipped with proper lenses. Most of these accessories are designed especially for this process. The necessary supplies consist of specially designed welding wire of the proper metal and size for the work under consideration, and the right carbons.

Morton Variable-Speed Transmission

This variable-speed transmission has an unlimited number of speed changes, and is quiet and powerful. It is possible to get a 3 to 1 speed range. All speed changes may be made while the machine is in motion and the cutting speed of the machine can be changed by inches if desired. The cutting speed or cutting feed per minute is indicated on a speed indicator within view of the operator at all times. The changes are accomplished by a handwheel within easy reach of the operator. A Reeves drive unit is used as part of this transmission. This drive is especially adapted to Morton high-duty draw-cut shapers.

This variable-speed transmission



Morton Variable-Speed Transmission

has been developed by the Morton Manufacturing Company, East Broadway and Hoyt St., Muskegon Heights, Michigan.

"Best Bet" Hack Saw Type Tool

A frame, which employs as a cutting element the regular hack saw blade, and which is suitable for cutting in close quarters and through the walls of cylinders, has been placed on the market by the Johnston Tool Company, Room 634, Rogers Building, Vancouver, Canada. The blade is held at one end in a slide fitted with a handle, and has its other end projecting through a head fitted with upper and lower rollers. The head of the frame is held against the work and the slide is moved along the guides to reciprocate the saw in its cut. The head forms a steady for the blade, so that while the blade is unsupported beyond the cut there is no tendency for it to break. The pressure is applied to the saw by bearing down lightly on the head, the pressure being transmitted to the back of the saw through the upper roller.

Since no supporting member projects beyond the head, the saw blade will cut in any position that the blade alone can enter. For example: To cut a cylindrical shell into two halves, a chisel cut is made in the side wall to pass the end of the blade, the saw blade is inserted, and the cut is made right around the side wall. A broken nipple in the end of a ¾-in. or larger pipe connection can be cut longitudinally and knocked out easily. Another use is that the lid can be removed from a packing case without damage, by inserting the blade between the lid and the case and cutting the nails. For overhead work the blade may be turned teeth uppermost.

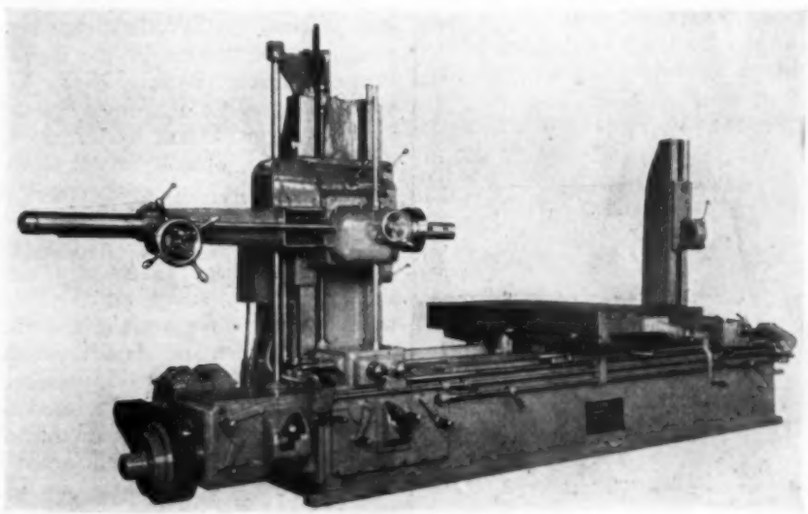
"Best-Bet" Hack Saw Type Tool which may be used for cutting in close quarters

Hill Horizontal Boring Machines

TWO sizes of this horizontal boring mill, which have 3- and 4-in. boring bars, respectively, have been developed by the Hill Clutch Machine & Foundry Company, 6400 Breakwater Ave., Cleveland, Ohio. The machine is of the precision type and will perform boring, milling and tapping operations. It can be furnished with any length of bed, height of column and outer support, and with larger than standard tables, if desired.

The bed is of cabinet form, allowing the operator to get close to the work. Adjustable taper bearings support the spindle, which can be adjusted to 0.001 in. Large milling cutters or other tools may be attached. The table and saddle are dovetailed and fitted with a steel taper gib, and verniers can be furnished for the table cross feed. All shafting used is made from special alloy steel, heat-treated and ground, and all bushings are of phosphor bronze.

All unnecessary handles are removed from the change gear and feed mechanism, and all feeds are engaged by a positive clutch. Shear pins protect the entire feed mechanism from injury. According to the manufacturer, all cross, vertical, and longitudinal feed screws are precision milled. The machine can be re-



Hill Horizontal Boring Machine

versed so that left-hand millers and cutters can be used.

Convenient control is obtained by means of a start and stop mechanism, of which both levers are adjustable and slide along the horizontal bars to any position within easy reach of the operator. This feature saves the operator's time and also permits the machine to be controlled without the operator taking his eyes from the work.

The machine is furnished with a ball bearing motor and V-belt drive. An automatic push-button starter is mounted on the base. If single belt drive is required in place of the motor drive, a single pulley is furnished.

Ingersoll-Rand Type 30 Air Compressors

A line of air-cooled, two-stage air compressors, known as the Type 30, has been placed on the market by the Ingersoll-Rand Company, 11 Broadway, New York, N. Y. A V-type belt drive is employed. Both the motor and the compressor are equipped with ball bearings.

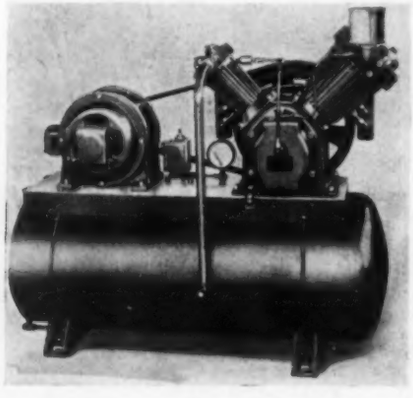
The units are self contained, the motor and the compressor being mounted on a steel base, which is attached to the top of the air reservoir. The latter, which is made of heavy pressed steel, is built to withstand a working pressuse of 200 lb. per sq.in. No special foundation is required for correct alignment of the compressor and the motor, and the compressor is ready to operate as soon as the electrical connections have been made and the crankcase filled with oil.

An intercooler is located behind the fan-type flywheel and a constant current of circulating air is driven directly across the cooling coils. Automatic stop and start controls are furnished as standard equipment. When the pressure in the air receiver reaches a point at which the regulator is set to unload, the motor is shut off automatically. A centrifugal governor allows the air in the high-pressure cylinder and inter-cooler to exhaust through the crankcase, so that the machine can be started off without a load.

Honed cylinders and two oil-control rings reduce the oil in the discharge air to a minimum. Each piston is run into its respective cylinder, insuring a good oil seal.

The base of the compressor unit forms a reservoir for the oil, and no pump is required. A bayonet gage gives positive indication of the amount of oil in the reservoir. A self-cleaning air cleaner keeps the dirt out of the compressor and requires no attention. The compressor is entirely inclosed. Destructive vibration is minimized by the use of a balanced crankshaft, and it is claimed that the improved two-stage design reduces the power consumption from 10 to 30 per cent, and also reduces the floor space.

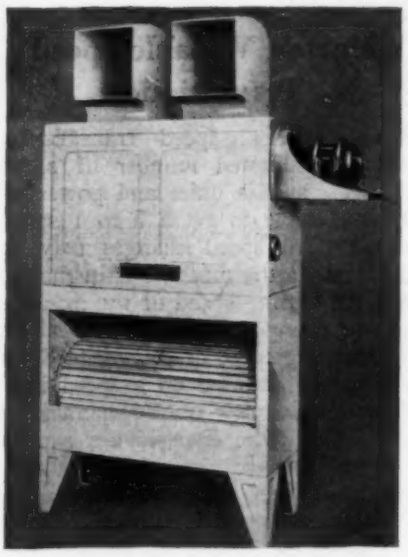
The compressor unit is built in four sizes, ¾, 1½, 3, and 5 horsepower. All sizes are built for working pressures up to 200 lb. per sq.in., continuous duty.



Ingersoll-Rand Type 30, Two-Stage, Air Cooled, Air Compressor

Buffalo "Wetboy" Unit Heater and Air Conditioner

For supplying conditioned air as well as heat, the "Wetboy" has been placed on the market by the Buffalo Forge Company, Buffalo, N. Y. The apparatus consists of a revolving air-washing drum, a unit heater system directly above, a motor-driven blower section, and the duct connections or outlets. The air washer is propelled by the air current through the unit and the scrubber plates dip continually in the water tank. Their wetted surfaces remove about 70 per cent of the dirt and dust from the air and add from 25 to 35 per cent moisture to the air. Dirt picked up from the air settles into the tank. A hose connection is provided, and the revolving drum can be lifted up and the collected dirt washed out through a drain connection. The water level in the tank is maintained automatically by means of a float. The apparatus does not require a pump, circulating piping, auxiliary motor, nor mechanism for circulating the water.



Buffalo "Wetboy" with Heater and Humidifier, front grill removed to show the revolving air washer

The multi-rotors are of the centrifugal type, each in its own fan housing, designed to deliver a large volume of air quietly and efficiently. The complete rotor and shaft assembly can be removed through the end plates without disturbing the top of the casing or the fan housing. The motor bracket end plate and the outboard end plate are interchangeable so that the drive can be placed on either end.

The heating element is made up of "Universal Aerofin" tubing for pressures from 2½ to 200 lb. gage.

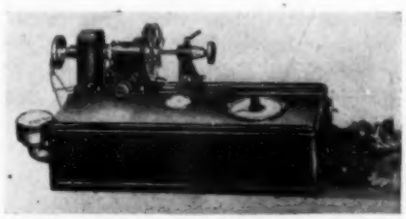
Losenhausenwerk Type S.K.I. Balancing Machine

For determining rapidly the static unbalance or center of gravity of large members of small rotors, the Type S.K.I. balancing machine has been introduced into the United States by Alfred Suter, 200 Fifth Ave., New York, N. Y. The machine is manufactured by Losenhausenwerk Machinenbau, A.G. Dusseldorf-Grafenburg, Germany. The machine will measure out-of-balance down to 80 gramms and up to 500 gramms, and the displacement of the center of gravity to 250 mm. Direct

current is required for driving the machine and for the electric balancing mechanism.

The machine consists of a cast-iron housing for the motor and a swinging pendulum, which is supported by two compression swinging springs. A mandrel serves to hold the test pieces tightly, and it can be exchanged for another of different diameter should the test pieces have different size bores. The apparatus is driven by a variable-speed, d.c. motor, to which is connected a tachometer for regulating the speed. The device is provided with a dial for indicating the out-of-balance, a dial for indicating the out-balance plane, a resistance, an indicator for the out-swing, and a set of springs.

The electric balancing mechanism consists of an interrupter which ro-



Losenhausenwerk Type S.K.I. Balancing Machine, which is suitable for determining the static unbalance of large quantities of small rotors

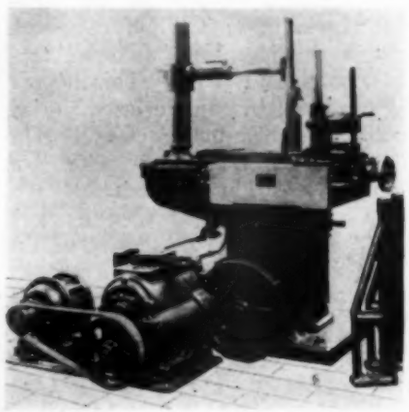
tates with the driving mechanism, and which is connected with a double magnet fastened to the non-rotating part of the machine. A handwheel is used to set the interrupter and a button controls the rheostat. After the test piece has reached the critical speed, the magnetic field is closed and opened periodically by the interrupter in such a way that a magnetic impulse is created for every half revolution. This counteracts the vibration caused by the out-of-balance of the piece. By proper regulation of the interrupter, the magnetic impulses can be controlled so as to be directly opposite the mechanical out-balance swing and counteract it entirely.

The amount and plane of the out-of-balance are read off and marked on the test piece. If the distances to which the balancing weights are to be fastened on the test pieces are always the same, the machine can be supplied with direct-reading dials for giving automatically the weights to be attached.

Morton Direct-Connected Reversing Drive Unit

This direct-connected reversing drive unit is designed for application to the Morton stationary keyway cutters, which are built with 18-, 24-, 38-, and 48-in. cutting strokes, respectively. It is of box-type construction with powerful multiple-disk clutches geared to give a 2 to 1 quick return ratio. It is self-lubricating; the clutches running in oil. The shafts are mounted on Timken roller bearings.

This reversing drive unit eliminates the countershaft and belts usually furnished with stationary keyway cutters. It is direct-connected to the machine by means of a flexible coupling, and is powerful, quiet running, and positive in its reversal. The unit can be applied to any of the Morton stationary keyway cutters in use. It has been de-

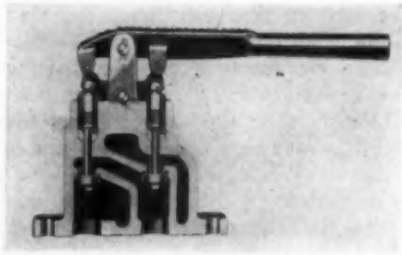


Morton Direct-Connected Reversing Drive Unit applied to a stationary keyway cutter

veloped by the Morton Manufacturing Company, East Broadway & Hoyt St., Muskegon Heights, Michigan.

Ross Improved Operating Valve

For the control of single- and double-acting cylinders, improved three-way and four-way valves have been placed on the market by the Ross Operating Valve Company, 6488 Epworth Boulevard, Detroit, Mich. These valves are similar to the others previously manufactured, but contain several improvements.



Ross Improved Operating Valve for controlling single- and double-acting cylinders

All ports are placed on one face, which makes possible the permanent installation of all piping to a bracket, and the quick removal of the valve by loosening the bolts which hold it in place. Other improvements consist of a poppet valve assembly which permits constant pressure packing and stronger and sturdier springs, composition disks that assure an air-tight seal, and hardened steel rockers. All four-way valves are now designed with a common intake port from the supply line, thus reducing piping to a minimum.

These valves are manufactured in two styles, type 4-P for double-acting cylinders, and type 3-P for single-acting cylinders. Either style can be furnished with locking or non-locking type rockers in $\frac{3}{8}$-, $\frac{1}{2}$-, $\frac{3}{4}$- and 1-in. sizes. Larger sizes can be furnished.

Lincoln Idling Device for "Stable Arc" Welders

An automatic idling device or throttle control for regulating the speed of the engine in "Stable Arc" welders of the gasoline-engine-driven type has recently been developed by

Lincoln Idling Device for "Stable Arc Welders"

the Lincoln Electric Company, Coit Road & Kirby Ave., Cleveland, Ohio. This device increases the speed of the engine automatically from the normal idling speed to the proper speed for welding service whenever the arc is struck. When welding is discontinued, the device automatically reduces the engine to the idling speed.

As shown by the accompanying illustration, the operating mechanism of the device consists principally of a small metal bellows and an electric magnet. When the arc is struck, the armature of the electric magnet opens a relief valve in the bellows, causing them to inflate, which in turn allows a coil spring to open the engine throttle. When welding operation ceases, the bellows are deflated by suction of the engine intake, thus causing the closing of the engine throttle to the idling position. The idling device is provided with a control lever that may be set for automatic throttle control, for continuous idling speed, or for governed speed.

The device is so designed that a momentary interruption in welding will not cause a reduction in the speed of the engine. It is estimated that the use of the automatic idling device will effect a saving in fuel consumption of approximately 25 per cent.

Hoppers for Cincinnati Centerless Grinders

IN THIS department for last week there was described a floor-level type hopper for the centerless grinders manufactured by Cincinnati Grinders, Incorporated, Cincinnati, Ohio. The company is also bringing out three other hoppers: the "Feed-Matic" in-feed hopper, illustrated in Fig. 1; the "Feed-Matic" through-feed hopper, shown in Fig. 2; and a motor-driven hopper for feeding tapered parts. Fig. 3 shows this type.

The Feed-Matic in-feed hopper, illustrated in Fig. 1, when used in conjunction with a centerless grinder equipped with the automatic in-feed attachment, is suitable for the automatic grinding of cylindrical work with a shoulder, such as valve tappets, bolts, and rivets. This hopper is powered by an inclosed, ½-hp. motor with push-button control. The motor drives a pick-up plate that swings vertically through an arc. This plate is located in the work basin, and on each movement of the plate, work is selected with shoulder end up. The work then slides down a receiving chute, through a tube, and into a receiving hinged member that delivers it to the work support blade. The hopper keeps the chute constantly supplied with work, and grinding is done almost continuously.

The ejector rod on the automatic in-feed attachment controls the timing of the hopper. Thus the same cycle that controls the in-feed also controls the selection of pieces by the hopper. It is claimed that there is no possibility of work jamming in the hopper. Changing this in-feed hopper by the application of additional parts to a through-feed hopper makes the unit capable of handling both in-feed and through-feed work.

The Feed-Matic through-feed hopper, shown in Fig. 2, handles the same type of work as the hopper illustrated and described last week, the floor-level type, but it operates on a different principle. Such work as cylindrical grinding of piston pins and bushings can be done. This hopper is identical to the in-feed type illustrated in Fig. 1, except that it does not have the arrangement for automatic in-feeding. Substituted for this mechanism is the gravity chute down which slide the straight cylindrical parts onto the work support blade. Except for this difference, the features of con-

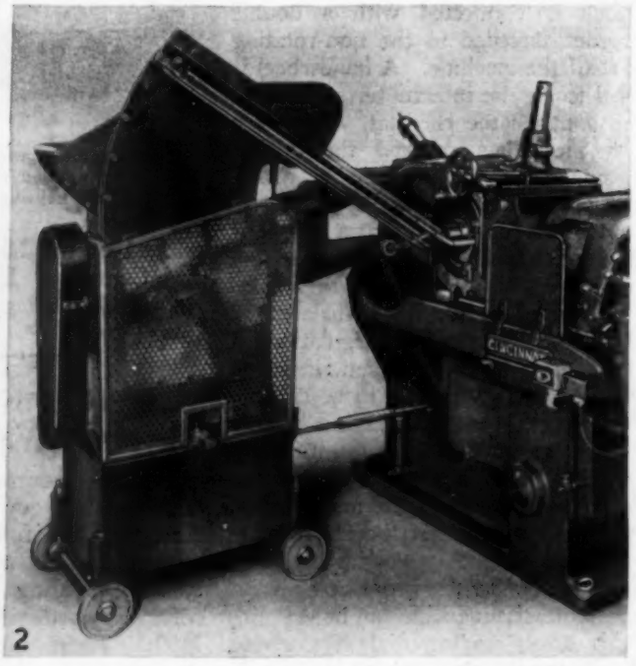


Fig. 1—Cincinnati "Feed-Matic" In-Feed Hopper, which is designed for application to centerless grinding machines
Fig. 2—"Feed-Matic" Through-Feed Hopper

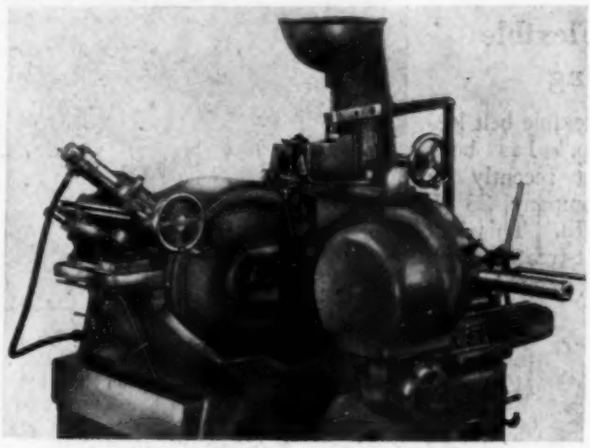


Fig. 3—Motor-Driven Hopper and Fixture for feeding tapered parts to Cincinnati Centerless Grinders

struction are the same. Both of these hoppers can be moved easily up to and away from the grinder. An adjustable tie rod keeps the hopper in the proper position, which is always maintained because the hopper wheels fit into the stationary floor plates. To compensate for wheel wear and to keep the hopper in alignment for accurate feeding, a cross adjustment is provided. Anti-friction bearings are used, wearing parts are hardened, and ample lubrication facilities are provided. If desired, additional parts can be supplied to convert the through-feed hopper to an in-feed hopper.

Illustrated in Fig. 3 is the motor-driven hopper and fixture for feeding tapered parts. Work is dumped into the basin, a vertical agitating tube selects the parts, and they are shifted so that the small end is down. Each part drops through a tube into position and a combination pusher and ejector arm forces it between the wheels the required depth for sizing and ejection of the piece. One man can operate a number of machines with this arrangement. The fixture used in connection with this hopper includes the work rest and blade of the correct taper. A tapered truing attachment over the regulating wheel is required to provide correct taper on the regulating wheel.

In cases where the hoppers are operated to feed a battery of machines, a substantial reduction in labor is possible since one operator runs a series of three to six machines. The handling of material is also dispensed with when consecutive feeding from one machine to another is employed, since the operator dumps a large amount of the work into the hopper basin of the initial machine, and, when the work drops out of the first unit, it is fed along by gravity to the hopper of the second unit, and so on, until completely finished. The process is thus entirely automatic.

Minster Screw or Tryout Press

THE Minster Machine Company, Minster, Ohio, has announced the screw or tryout press illustrated. This press is made in various sizes and is designed with the same frame construction and accuracy as a straight-side press.

The frame is of four-piece, steel, tie-rod construction. The base and crown are heavily ribbed to insure minimum deflection, while the uprights are extra heavy to withstand lateral stresses. Both uprights are slotted from right to left and front to back, and these slots receive the tongues milled in the crown and base, preventing the frame from shifting under extreme pressures.

The screws are made of high-carbon steel, and have special milled threads having a flat face on the pressure side. They are specially adapted for taking heavy thrusts without producing a spreading strain. A heavy slide is used, and it is well ribbed, both front to back and right to left. The ways of the slide are extremely long, and adjusted so that alignment is maintained for operation of cutting and perforating dies, as well as other dies requiring accuracy of movement. The screws are held stationary by rigid clamping means in the slide. The two threaded sleeves, operating on the screws, are mounted in the crown of the press. Thrust on these sleeves is taken up by two heavy roller bearings.

The press is designed so that a 5-hp. motor, through a train of gears, actuates the threaded sleeves on the screws, and moves the slide at 9 in. per minute. An automatic reversing switch with an overload relay controls the motor, which has sufficient capacity for exerting pressures to 50 tons on the ram. At this pressure the overload relay cuts out the motor. The clutch is then switched to the ratchet, which is operated by hand, and which is capable of exerting a pressure of 100 tons. The slide is arranged to receive cross bar knockouts, and the base is arranged to receive either spring pressure attachments or air cushions.

The specifications are as follows: Diam. of screws, 4 in.; travel of slide, 18 in.; distance between uprights (to clear), 60 in.; area of bolster plate, F-B x R-L, 32x60 in.; area of slide, F-B x R-L, 23x55½ in.; and opening in bed, F-B x R-L, 21x58 inches.

Minster Screw or Tryout Press

"Ready" Ball Bearing Live Center

To aid in the economical use of tungsten-carbide tools, for which it is necessary that chatter be minimized so that the edges do not break down easily, a ball-bearing live center, illustrated in Fig. 1, has been placed on

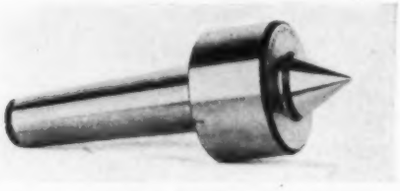


Fig. 1—"Ready" Ball-Bearing Live Center, New Departure ball bearing equipped

the market by the Ready Tool Company, Bridgeport, Conn. The ball-bearing center gives rigid and accurate support under all load and speed conditions. As shown in Fig 2, the two rows of balls in the New Departure double-row ball-bearing are opposed in a definitely preloaded condition. This angular contact bearing has solid, high-carbon, chrome-steel inner and outer races.

In this design, when the center is set up, the work is brought close to

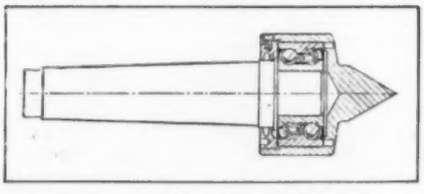


Fig. 2—Cross-section showing the angular contact

the tailstock so that the rigidity of the bearing is not offset by deflection of other parts, which would result were there a considerable overhang. Another feature is that the housing closure or seal is located on the side opposite the work, and is therefore protected from direct force of the cutting compound. This rotating housing helps to keep the lubricant within the bearing, but throws compound and chips away from the bearing seal.

The ball bearing is so mounted that the outer race rotates with the nose of the center. The nose, or point, is ground after assembly, and therefore runs true. If regrinding of the nose is required, it may be accomplished readily without removing the center from the machine, since the nose may be driven by a belt around the bearing housing while a cut is taken with a small grinder adjusted to the angle of the point. The bearing used requires no attention to lubrication or adjustment of any kind. It is manufactured in the most used taper sizes, but tapers of any type or size can be made to order.

"Steelgrip" Flexible Belt Lacing

A complete line of flexible belt lacing, called "Steelgrip," has been placed on the market recently by Armstrong-Bray & Company, 28 N. Clinton St., Chicago, Ill. This belt lacing is made of heat-treated steel. The joint of the lacing is made with

Showing appearance of "Steelgrip" Flexible Belt Lacing before and after application to a belt

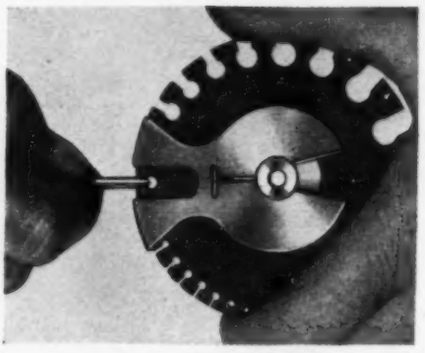
a steel rocker pin, which is composed of two segments, one rocking against the other.

Steelgrip belt lacing may be used for leather, fabric, or composition belts, and may be applied by means of a hammer. When in place it is smooth on both sides and flexible. It is made for $\frac{3}{16}$- to $\frac{1}{2}$-in. belts.

Brown & Sharpe Nos. 698A and 698B Wire Gage Selectors

Two wire gage selectors designed to simplify the gaging of wire have been placed on the market by the Brown & Sharpe Manufacturing Company, Providence, R. I. They are known as Nos. 698 A and 698 B, respectively. These selectors as are shown by the accompanying illustrations cover up the slots in the wire gage adjacent to the one being used, so that the one slot in the wire gage for any particular size is made accessible for fast and easy gaging of a large number of pieces of wire.

The selectors are easily and quickly attached to wire gages. The spring fingers of the selector arm snap around the stud on the disk holding the selector in place on the wire gage. If desired, the selector is as easily removed. There are no screws or nuts to become lost. The No. 698 A is intended for use on B. & S. wire

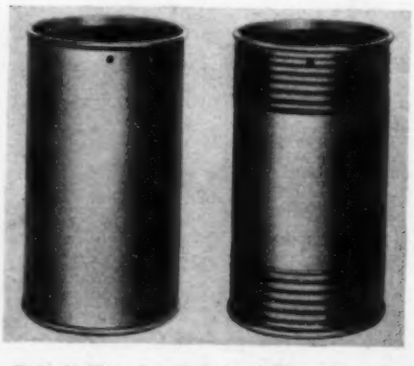


Showing the Brown & Sharpe Wire Gage Selector in use on a wire gage to cover up lots next the one wanted

gages Nos. 688 (5 to 36) and 690 (6 to 36), and selector No. 698 B for use on B. & S. wire gages Nos. 688 (0 to 36), 690 (1 to 36), 692, and 694.

"Detroit" Steel Shop Barrels

In place of nondescript barrels and boxes for shop containers, the "Detroit" steel shop barrels may be substituted with assurance that they will not leak oil when filled with machined products. The No. 4 barrel, illustrated at the left in the accompanying illustration, and the No. 5, illustrated at the right, are both liquid tight, both being made with a No. 16 gage shell and a 14 gage bottom. They stand 30 in. high, are $17\frac{3}{4}$ in. in outside diameter at the chime, and $16\frac{3}{4}$ in. in inside diameter of the shell. They have a capacity of 30 gallons and weigh 47 lb. If desired these barrels may be equipped with trunnions, and may also be furnished in 50-gal. capacities. The barrels have been placed on the market by the Detroit Steel Barrel Company, Toledo, Ohio.



Detroit Nos. 4 and 5 Steel Shop Barrels

NEWS
OF THE WEEK

Machinery and Machine Tools in Germany. France, and Great Britain

A year-end review of conditions in overseas centers, as seen by correspondents

Germany

By Trade Commissioner James H. Wallis, Jr.

THE German machinery industry, which during the first six months of this year enjoyed a comparatively favorable business development, appears to have suffered a set-back during the third quarter, as evidenced by reports issued by the German Machinery Manufacturers' Association (Verein Deutscher Maschinenbau Austalten). A backward glance at the course of business in the German machinery industry during the first half of 1929 shows an upward trend, almost exclusively the result of improved export trade. The total amount of orders increased during this period, and although this improvement was somewhat irregular, no great reverses were suffered. Thus the total for the first six months of this year exceeded that of the second half of 1928 by about 13 per cent.

Foreign business became of increasingly greater importance, so that the value of export orders during the first half of 1929 was approximately 44 per cent of the total orders received by the whole industry. This figure amounted to 40 per cent during the second half of 1928 and 36 per cent for the first six months of last year.

On account of depressed conditions during the months of January and February, domestic orders for the first half of the current year exceeded those of the previous six months by only about one per cent, and were nine per cent less than for the first half of 1928. Between the months of February and June, the degree of plant activity increased gradually from 67 to 70 per cent. The total of full-time workers and the number of working hours showed a similar trend.

This rather favorable sales picture is somewhat tempered by the effect on the German machinery industry of increases in prices for raw materials, wages, and money rates during the first six months. It was apparently impossible to effect any corresponding price increase, and this fact is reflected in the machinery price index of the Federal Statistical Office, which was somewhat lower than during the second half of 1928.

The general development of the machinery industry showed a downward trend during the third quarter, and this was apparently not entirely a result of the usual seasonal summer dullness. This decline was most strongly evidenced by the falling off of domestic orders. Foreign orders did not reach the June figure during any of the following three months, but were on the whole decidedly better than those received from the home market and greatly strengthened the general situation. During the third quarter, foreign business constituted one-half of all the orders received by the German machinery industry.

There appears to be a general feeling that one of the principal reasons for this recent unfavorable change is the shortage of capital in Germany. During the past year, the industry has had greater difficulty in securing new funds than previously. The capacity of the internal market for absorbing new stock issues and securities paying a fixed rate of interest has become more limited. A similar tendency is apparent as far as the inflow of foreign loans is concerned. This is reported to be reducing the profits of German undertakings and impeding new industrial investments. The decrease in machinery sales on the home market is a direct result of this.

In some quarters, there is a feeling that the smaller number of inquiries and orders from abroad may be the result of similar difficulties in various other countries. For this reason, the German Machinery Manufacturers fear that the whole foreign-trade situation may be seriously affected and believe that everything possible should be done to prepare the German machinery industry for such a contingency.

Remedial Measures Proposed

Measures for relief from taxation and other burdens borne by the machinery industry in Germany are being urged and there is also a general feeling among German machinery manufacturers that very important changes must be made in the organization of the industry before any real improvement in the present unsatisfactory condition can take place. There is at present far too little specialization, although this condition is showing some improvement as the result of consolidations and exchanges of manufacturing programs. Instead of producing one line of machinery on a low-cost basis, German manufacturers have a tendency to enter on a too-varied program in order to utilize their excess capacity. It is a fact that whenever there is a demand for some particular type of machine, a large number of manufacturers immediately start producing it, with the result that within a short time there is a condition of overproduction.

The German Machinery Manufacturers' Association, as well as the various subsidiary associations of the industry, are doing their utmost to bring about a reduction in production costs, through specialization and co-operation between the various producers. Noticeable progress is already being made along these lines, and it is evident that this organized effort will before long be reflected in the greater returns to the industry as a whole.

France

By Our Paris Correspondent

THREE major issues are again clogging the wheels of French industrial progress. They are the subject of the Paris conference on the treatment of foreigners being held under the auspices of the League of Nations. The topics cover manufacturing plants founded by foreigners in a country not their own, financial institutions, and individual interests. The conference is a subject of great moment and may be the means of establishing a world charter, whereby the foreigner operating abroad will in the future be relieved from some of the vexations and costs which are imposed today. Another issue is the imminence of the adoption of a Tariff Truce Convention, which also originated with the League of Nations at Geneva. Then there are the matters of reparations under the Young Plan and the functioning of the International Bank for Payments.

Allied with the above, and of a real economic purport, are the questions of the 10-year lease of life given to German payments-in-kind, the possible evacuation of the Saar by the French, and the loss of a growing French trade there.

There is no doubting the detriment which German reparations payments-in-kind are bringing to many French industries and to other industries abroad which depend upon any share of French trade. It is apparent in the machinery and tool trades. The trade association of the locomotive industry claims that French makers of locomotives and rolling stock have seen half of the bulk of French orders go to Ger-

many, further stating that during the first five months of the present year, not a single locomotive order from the seven principal French railways went to French makers. Probably there is not a French metal-transforming industry that is not meeting with a similar state of affairs.

Most French Trade Should Be At Home

There is a very well-defined opinion here that the French market is, after all, where the bulk of French business lies, not neglecting trade with the colonies and protectorates, but obviously taking account of the shrinking of French exports since the first of the year. French plants have re-equipped and modernized themselves, but apart from certain big output industries, this procedure has not been carried to its end. The French market for plant equipment is by no means saturated. The fact that unemployment does not exist is proof that capacity production has not yet been achieved. An authority has stated that orders are booked ahead in most metal-fabricating lines, which will further assure this state of affairs for weeks and months. It is not denied, however, that production costs are steadily rising as a result of numerous factors. Chief among them are fiscal taxes. The new French cabinet promises an amelioration in this respect, but it will not follow through the whole scale of industrial life at once, and the present cabinet may not be in power long enough to continue its policies of tax reduction the second time. They proclaim a politics of prosperity, but that usually demands a long term. Industry wants it, but capacity production without profits is of that same brand of fictitious prosperity with which many other countries besides France have had experience.

The foundry industry, working to model, complains that automobile and accessory manufacturers have only partially "come through" with orders in series for the next campaign. They profess not to be able to explain the situation. Others, specializing on small trucks and delivery vehicles, have apparently entered an unwonted period of progression. Industry in the east of France complains, however, that labor is less plentiful than required for working to capacity.

The French machinery industry is certainly making progress and enlarging the scope of its lines, but is feeling the import competition more than ever. Paper-making machinery imports, as an example, increased in value during eight months of the present year from 13 million francs to 40 million francs.

Electrical machinery and accessory imports from Germany are steadily increasing. Machine-tool imports from Germany have doubled their volume for six months, as compared with the same period of 1928.

The price index is still proving an inexplicable enigma. In general, it runs well above 600 and in some cases approaches 700, while the French pre-war franc stands at 500. Wages have not risen proportionately, nor have dividends and profits. Fiscal taxes of every sort have been imposed which handicap trade relations and consumer interests alike.

The first of November brought a rise of 8 points on national products, but there was a drop of 32 points on imported products. This should indicate that other countries were holding their own or actually reducing prices on their particular exports which France absorbs. The comparison is full of suggestion. Minerals and metals are indexed at 611, a drop from 623 on Sept. 1.

There is no question that tariff issues offer the most disquieting influence throughout Europe, and rather more so in France than elsewhere. The solution of a United States of Europe lowering these barriers between European states is, if not a probability, a possibility, though the Dutch Minister of Foreign Affairs recently called the attention of his government to this being a sure means of antagonizing the United States and, perhaps, Great Britain as well.

Nine-months foreign trade exchanges show no marked differences from those which were indicated at the end of the first six-month period of the year. In spite of this net gain on the year's foreign trading, imports from the United States for the first nine months of the year show an increase in value of 832,059,000 francs, while exports dropped nearly one hundred millions. Exports to Germany were off, as they were to Great Britain, but they increased slightly to Italy. Imports from Germany were increased perceptibly, likewise from Great Britain, but there was a falling off from Italy.

Great Britain

By Our London Correspondent

UNEMPLOYMENT remains the nemesis of the industrial situation in Great Britain. Workpeople registering at the labor exchanges have increased slowly. The increase is seasonal, however, and the figures are certainly below those for the corresponding period of last year. The minister especially responsible for attacking the problem has stated his proposals, but they have been received as hardly likely to solve the problem or even to ameliorate conditions greatly. Any change in engineering generally is not marked, and for the most part, the machine-tool section still remains well occupied, though a tendency to decline has been noted for a number of weeks past. Inquiries have been less numerous, new orders have not always kept pace with contracts completed, and complaints of price cutting have been heard.

The application for an increase in the wages of engineering workpeople has been definitely refused. Admitting that an increase is desirable, the spokesman for the employers urged that the industry was unable to pay it, arguing also that, in fact, real earnings of workers are somewhat higher than they were before the war. A difference ranging from 2½ to 40 per cent was mentioned in the prices submitted by overseas competitors, costs being higher and hours of working lower in Great Britain, while it was asserted that "longer and even impossible credits are being demanded in exchange for the granting of orders." Although, as a result of recent legislation, the production industries are being relieved of a large proportion of the charges for local rates, this advantage is held to be offset, or nearly offset, by the increased demand made by taxation for social purposes. These demands have been estimated to amount last year to 379 million pounds, as compared with 63 million pounds in 1911. (According to a special report, the increase in taxation since the war has been 570 per cent, as applied to electrical manufacturing.) The sum spent on social services is, it was claimed, really itself an advance of wages. It is the unskilled and laboring workpeople that have made anything like a substantial advance in wages actually handled, whether as calculated on a basis of time or on payment by results. Apparently in engineering, the proportion of the latter class is increasing, for the ratio of time workers to payment-by-results workers is put as 7 to 3 in 1919, but as 1 to 1 at the beginning of the current year.

View Is Perhaps Too Pessimistic

It is possible to think that a too pessimistic view has been taken. No doubt when refusing such an application, it is necessary to be diplomatic. The Federation of British Industries has called attention to the different attitude of the United States on such matters. Apropos the recent stock market trouble. "Although the United States is still feeling," it says "the effects of a financial shock as great as that sustained by any country in the present century, no news except of an optimistic nature now appears from New York." Over here, makers of steam locomotives, railway cars, and similar equipment seem to be receiving a fairly steady stream of orders from abroad. The home railways, of course, meet most of their needs in their own shops.

The troubles of Wall Street were of course not without their repercussions in the rest of the world, but, as far as can be seen outside the money market, Great Britain felt no serious effect. Nor is it anticipated that the basic manufacturing industries will suffer directly, for it is understood that the exports from Great Britain into the United States are mainly of the luxury character, the tariff, if nothing else, being a sufficient deterrent to other articles. Some members of the motor-car industry incline to look doubtfully on their own prospects in overseas markets, for we are being told that many cars sold on the other side on the gradual payment system are being returned.

U. S. Industrial Output Makes New High Record

American industrial output during the fiscal year ended June 30 was the highest ever attained, according to the annual report of Secretary of Commerce Lamont. The comprehensive index of production of manufactured commodities stood at 117, as compared with 100 in the years 1923-1925, and was nine points higher than the previous peak reached in 1927. The year was characterized by record production in a number of special industries, large employment and payrolls, largest net operating income of Class I railroads ever reported, expansion of many phases of finance, and a greater volume of exports than in any previous fiscal year. Factory production at the end of June, 1929, is shown at 27 per cent above the average months of 1923-1925, and 13 per cent above the highest month in any fiscal year before 1929.

* * *

Standards Group Joins World Body

The American Standards Association, at its annual meeting in the Hotel Astor, New York City, on Dec. 18, announced that it had joined, as the eighteenth member organization, the International Standards Association, which has its headquarters at Zurich, Switzerland. This action, according to W. J. Serrill, Philadelphia, president of the association, is expected to prove invaluable to members of the association who are exporters to competitive foreign markets. The association will endeavor to make available to American exporters knowledge of the requirements of foreign buyers who want products complying with their own national standards. Through a budget increase, three men will be added to the technical staff of the association.

* * *

Machinery Employment Shows Slight Decrease

An advance bulletin covering employment in the machinery industry, issued by the Bureau of Business Research of Ohio State University, showed that November employment was 3 per cent less than October this year and was 7 per cent greater than that of November last year. Average employment during the first eleven months of the year was 15 per cent greater than that during the corresponding period in 1928.

In the field of special-purpose machinery and appliances, November employment was 6 per cent less than in October of this year and 4 per cent greater than that in November, 1928. In the field of electrical machinery, apparatus, and supplies, November employment was practically the same as that in October of this year and was 14 per cent greater than that in November of last year. November employment in the machine-tool field was the same as that of the preceding month and also for November, 1928. Employment in material handling and power equipment for November was 1 per cent less than that in October of this year, and 1 per cent greater than that in November of 1928.

* * *

Mid-West Steel Merger Links $350,000,000

A consolidation of independent steel interests in the middle west, by which a $350,000,000 company is created, ranking as the third largest in the country, was announced recently. The merger, which was shaped by a powerful financial group headed by Cyrus S. Eaton, Cleveland capitalist, is built around the Republic Iron & Steel Co. and includes also the Central Alloy Steel Corporation, Donner Steel, Inc., and the Bourne-Fuller Co., as well as the subsidiaries of this group. Directors of the four companies which are to be combined approved the merger plan on Dec. 17. Details of the amalgamation will be submitted to stockholders of the companies for ratification. The consolidated unit will be known as the Republic Steel Corporation and will be headed by Tom M. Girdler, as chairman of the board. He recently resigned as president of the Jones & Laughlin Steel Corporation. E. T. McCleary will be president of the new company.

* * *

Lamson & Sessions Offers To Buy Foster Bolt Company

Further expansion plans of the Lamson & Sessions Co., Cleveland, Ohio, were revealed recently by George S. Case, president, who confirmed reports that the company had made an offer to purchase the Foster Bolt & Nut Manufacturing Co., Chicago, on an exchange of stock basis. This will give the Lamson & Sessions Co. a plant in Chicago, as well as another unit in Cleveland, if Foster directors approve the deal. Consolidation of the Lake Erie Bolt & Nut Co. with Lamson & Sessions was effected Dec. 1, and it is likely that the expansion has not ended. A. M. Foster is chairman of the Foster company, and James F. Donahue is president. The company has a plant at E. 72d and Union Ave., S. E., Cleveland, where operations were begun about 20 years ago.

* * *

THE annual dinner of the Society of Automotive Engineers will be held in New York at the Hotel Pennsylvania, on the evening of Jan. 9, 1930. W. B. Stout will be toastmaster, and Col. Sidney D. Waldon, president of the Detroit Rapid Transit Commission, will be the principal speaker.

MacDonald Plans Machinery Library

A complete machinery library with complete information concerning the machinery in use in all industries will be established at the MacDonald Brothers Engineering Laboratories, Inc., according to an announcement recently by H. E. MacDonald, vice-president and general manager of the laboratories organization. The library is expected to be used by purchasers of machinery and allied supplies, and also by technical schools and colleges of the country. Their teachers and students will be allowed the use of its service free of charge. The library will be complete by the time the new building is opened.

* * *

Stanley Electric Tool Purchases Two Companies

Purchase of the Unishear Co., Inc., New York City, and the Crowe Safety Saw Co., Inc., Cincinnati, Ohio, by the Stanley Electric Tool Co., a subsidiary of the Stanley Works, New Britain, Conn., was announced on Dec. 18. The business of the two companies will be brought to New Britain. The Stanley Electric Tool Co. recently acquired the Ajax Hammer Co., New York City, and the L. R. Carter Co., Syracuse, New York.

* * *

Billion Expenditures On Railroad Program

Expenditures of $1,050,000,000 for new equipment, additions, and betterments to property used in connection with the transportation service are called for in the present budgets of the Class 1 railroads for 1930. It is estimated that the first quarter will absorb $212,000,000, and the second quarter, $278,000,000, or a total for the first six months of $490,000,000, as compared with $350,000,000 for the first six months of 1929. There is at present a greater program of expenditures for improvement underway than at any time during the past five years. This program calls for the expenditure during the next few months of $674,000,000, or $272,000,000 more than on the corresponding date in 1928.

* * *

MANUFACTURING concerns in any part of the country which face production and distribution difficulties incident to plant locations, will have at their disposal the technical engineering staff of the newly organized Industrial Development Bureau of the Niagara Hudson Power Corporation, of New York, according to a recent announcement. The bureau has been organized to promote the industrial development of New York State, not as a matter of philanthropy, but as a sound business policy.

BUSINESS · BAROMETER

Business is considerably better than was expected a month ago; general activity is up to expectations

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

SO FAR as economic conditions in the United States are concerned, the one thing of which we can be certain is that the country is richer today than it was a year ago. The measure of this gain is the excess of our production over our consumption. There has been no war, and the waste and loss otherwise has not been greater than usual.

This is true despite the so-called panic in the stock market. It did not destroy any property, although it may have reduced the nominal value that had been put upon some shares and bonds by those who owned them, or had become infected by the speculative fever that was an epidemic a few weeks ago. But even when this fever was at its height, it did not destroy intrinsic worth, and the only effect of its subsidence has been a revision of quotations. Except as it may be emotionally depressing, this revision should not affect the earning power of any of the properties involved. By convincing ourselves of the correctness of this view and impressing it upon others, we can do much to assist President Hoover in his efforts to re-establish normal activity. Therefore, it is urged that "A peaceful America grows richer daily" should be adopted as our slogan for 1930.

Meanwhile, it is gratifying to report that business is better than was expected a month ago. In New York and the other large cities, the Christmas trade is fully up to expectations. There is some decrease in the expenditure for high-priced luxuries, but the total volume of sales, as reported by some of the more important department stores, is in excess of that of last year, and the wholesale markets are commencing to reflect the confidence that retail distributors feel in a fairly good spring trade. Perhaps it is not generally appreciated that out of a total population estimated at 120,000,000, there are but 345,897 persons in the United States who reported incomes of as much as $10,000 or more in the year 1928. This group includes most of those who would be buyers of luxuries, and it is such a small one that its purchases are not of great importance in relation to the enormous volume of trade generated by the production and consumption of those who have less than $10,000 a year out of which to spend and save. Perhaps this explains why general business has been so little affected by the decline in the stock market.

November statistics show a slight decrease in car loadings and in the number of persons who were industrially employed during the month, but the falling off is small. In the automobile industry and probably in others, the downward trend of employment seems to have been promptly arrested following President Hoover's conferences.

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

NEW YEAR prospects in the machinery and machine-tool industry are considered entirely satisfactory. Conservative opinion in the field has it that 1930 business will at least equal that of 1928, a good year. No one believes that the 1929 records are likely to be equalled. A number of programs of expansion are planned in a wide variety of fields, and many of these will require machine tools.

THERE is no doubt that 1929 was a satisfactory year. With the exception of the months of November and December, records were set in practically all sections of the country. Sales were to no specific industries, and for no particular class of tools. The used-tool market has been good all year because of poor deliveries on new tools. It has dropped off now.

CANADIAN business is exceptionally good. New England is optimistic, and an upward trend is expected with the New Year. New York dealers reported a good week's business, with textile, paper, and glass manufactories indicating the diversity of purchasers. The Cincinnati market is holding up well. Indianapolis business is spotty. The Chicago market is quiet, as are also the Detroit and Southern District markets. This is directly a result of the holidays. No price changes are expected. Deliveries are getting better slowly. All in all, the feeling is decidedly optimistic and is expected to be better than that soon.

The cotton goods trade is still depressed by the alleged over-production, but there are many shrewd observers who think that stocks have become almost negligible as a result of hand-to-mouth buying, and that trade improvement cannot be deferred long after the first of the year.

Money promises to grow still easier. Credit will soon be abundant. Present losses of gold can and will be offset by the release of Federal Reserve credit for the use of the Member banks. The stock market is showing healthy steadiness, but speculation is still restrained and discriminating. The inquiry for steel is increasing, although the downward trend of production, which is now considerably below last year, probably will not be reversed until after the holidays. Many new buildings are being planned or provided for. The automobile industry has increased its output slightly, and though the manufacturers will operate conservatively during the first quarter they expect great improvement thereafter.

The commodity markets have been generally steady, but coffee reflects the doubtful financial position in which Brazil has been drawn by her efforts to sustain the price of her most important product. Coffee is below the cost of production and may be regarded as intrinsically cheap, but there is no knowing what will happen when the floodgates that impound the present stocks are swung wide open. Wheat is a little cheaper, but the fluctuations are without special significance, and raw cotton continues quiet pending the development of some new features that will change public opinion in regard to the value of the staple.

The news from abroad is, in the main, satisfactory. From the press dispatches, the outlook in China appears to be disturbed, but some private advices insist that there is little real fighting between the troops that are said to be marshalled in opposition to each other.

After the first of January, American business ought to resume its normal pace, and if it shall show itself able to throw off the depression caused by the November slump in Wall Street, we ought to have a good spring trade and a summer of encouraging activity.

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THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine-tool business

THE following reports, gathered from the various machinery and machine-tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CANADA

The placing by the Canadian National Railways of equipment orders totalling nearly $10,000,000 was the feature of the Canadian metal-working market during the last fortnight. The largest contract went to the Canadian Car and Foundry Co., involving a sum of $6,300,000. The contract is said to cover the construction of more than 2,000 box cars. The other contract went to the National Steel Car Co., covering equipment valued at $3,500,000. Thus far the Canadian Pacific has not announced its plans for 1930 equipment, but it is expected that orders will run into several millions. The Beauharnois Power Corporation has placed an order to the value of $150,000 with the Canadian Locomotive Co., which calls for ten construction locomotives.

Officials of the Dodge Manufacturing Co., Ltd., announce that they have received an order for all the elevator machinery and equipment for the new government elevator at Prescott, Ont. This order will approximate $300,000. Manufacturers of electrical appliances report that the sales volume for 1929 will be ahead of 1928.

NEW ENGLAND

Despite more evidence of curtailment in certain industries, there is a spirit of optimism among leaders in the machine-tool field. Orders are being placed at the rate that has characterized the industry through December, and the general opinion prevails that an upward trend is unlikely until inventories have been concluded and stocks adjusted.

Prospects are encouraging in the New England section. Railroad budgets point to heavier purchases of machine tools in 1930 than were experienced this year. Shop equipment buying is anticipated in financial plans of the Boston & Maine, the Boston & Albany and the N. Y., N. H. & H. railroads. The aeronautical industry plans further expansion to include airports and factories. Buying from this source is expected at a rate comparable with that of the best months of this year.

Sales during the week included a boring machine, large grinder, woodworking planer, small lathes and drills, and a two-figure order for special machinery. Construction machinery has been selling well, and budgets in all New England states hold strong promise for continued sales in this line in connection with road work. Good buying is anticipated from Russia, Germany, and France.

NEW YORK

New York machinery and machine-tool dealers report a good week's business, better than last week's, and considerably better than expected so close to the Christmas holidays. Some dealers report sales to medium and large companies, most of which were supposed to be out of the field until the middle of January. One or two dealers reported a dropping off, but considered it merely a result of the Christmas season and consequent postponements until after the holidays. Purchases are mainly for single items, from many sources. There has been some demand for toolroom equipment, one purchase being of 7 Ames bench millers, a similar order being for 3 floor millers. The railroads are doing a little business, but considerably more is expected after the first, mainly on items which have been postponed already too long. In addition to the regularly expected purchasers, a number of unrelated industries are buying, such as textile mills, paper mills, and glass manufacturers.

Inquiries are coming in in good volume. The Erie and Lackawanna railroads have lists out. Most of the New York Central list has been closed. The used-tool market continues poor. There has been some municipal business. Prices are unchanged and deliveries are improving.

All prospects point to an exceptional year in 1930, at least up to the standard of 1928. Little change in the situation is expected before the middle of January, however.

CINCINNATI

Machine-tool manufacturers of the Cincinnati district express great satisfaction because of the way the market is holding up. Comparing the past week to the previous one, the majority report that sales either showed a slight gain or held to the same level. The general condition in the machine-tool market is normal for the season. Plants are operating with their usual forces, and there has been no curtailment of output.

Selling agents report that, considering the fact that it is so near to the end of the year, at which time there always is a tendency to postpone buying, they are having an excellent demand. Inquiries are coming in freely, and a good volume of business is developing in local and adjacent territory.

While no large purchases are reported by manufacturers during the past week, business was well maintained by a good volume of well-diversified orders for single tools and replacements. The principal buyers were miscellaneous users and general machinists, located in all sections of the country.

Among the week's inquiries were several small lists of requirements from railroads, and there also were scattering inquiries from the automotive field, for replacements and special tools. A good volume of general inquiries were received from small users, located in all sections of the country, these being largely confined to single pieces of equipment of efficient types.

INDIANAPOLIS

Machinery and machine-tool business seems to have become rather spotted in this territory, and little actual business is expected in some lines until after the first of the year. The automobile industry, particularly here in Indianapolis, seems a little stronger and the tool requirements are a little heavier than they were. Much the same is true of the garage business, where severe weather has caused much business hardly looked for at this time of the year.

Aviation continues to be one of the increasing users of special machinery and machine tools. The local trade is looking for this industry to become a better customer during the coming year. The Indiana glass trade also has been making some purchases, now that they are in the midst of their winter's run of products for next year.

The volume of export trade is very satisfactory, according to local manufacturers. One maker of heavy lathes says business has been exceptionally good and a maker of special glass-manufacturing machines in Anderson has increased the scope of his export trade heavily this year.

Railroad business is fair only. Such equipment as is being purchased is in single lots mostly and no large orders are expected until after the first of the year. However, some equipment is being sold to car manufacturers in the state, where business is reported to be fair for this time of the year.

Many in the trade believe the demand from the construction industry next year will furnish one of the highlights of the year. Every effort is being made in Indiana to induce everybody who has intended building to do so next year. Dealers in second-hand tools report a fair business, and in some instances, a really good trade.

CHICAGO

The near approach of the holidays finds the machine-tool market quiet. Inquiries have slackened somewhat, and bookings are light. The usual seasonal falling-off is no greater than in any former years, selling agents and district managers reporting that such recession as is being experienced had been expected. From present indications, the average of business for the month of December will compare favorably with that of last month, in some lines exceeding it. The taking of inventories and the preparing of budgets for 1930, now begun with many industrialists, will have the tendency to keep conditions at their present level until well on in January, it is said, but there is declared to be good ground for believing that an active period of buying will start early next year. A report is current that the Illinois Steel Co. will enter the market with an unusually large list of needed shop equipment in the near future, but the extent of this buying is said to be a matter of conjecture. Such business as may be relied upon during the first months of 1930 with a degree of confidence, according to leaders in the machinery industry, will come mainly from builders of farm implements and tractors, general industry and, in less volume, from railroads.

WASHINGTON

Because of the centering of industrial attention at the nation's capitol during the past few weeks, the following report of conditions, as seen from Washington, is presented.

Business is slower but not slow. While there is no statistical evidence as yet that it has turned the corner, many well-informed persons believe that it has. Facts inevitably are ahead of the statistics, but it is only when the statistics become available that the fact can be established.

The interior banking situation is beginning to loosen up. If the present rate continues, banks in all parts of the country will be in good shape before the end of January.

There is less federal reserve credit out-

standing as a result of the fact that the country has more gold than it had a year ago. The United States has lost $75,000,000 in gold since the slump of the stock market. This represents one-third of the gain in the preceding year and a half. This has not tightened the credit situation, because the Federal Reserve Banks have bought securities as an offset. When they buy securities, it puts money in the market without any one being in debt. Otherwise, member banks would borrow from reserve banks. When a member bank is in debt, it is more reluctant to loan to its customers.

There are two outstanding leftovers in the public mind. One has its rise in the practice of the country bankers in pursuing a highly conservative policy at this time. For reasons never satisfactorily explained, there seems to be a very general policy on the part of country bankers to be liberal in making loans in times of inflation, when the effect is to aggravate the situation, then to tighten up at a time when that policy does most harm. It is held that the banker ought to be willing to lend more money in a sober situation when values are reasonable than in a runaway situation when values are inflated and more business is being carried on than prospects justify. The banker is likely to be influenced by mass psychology and to be over-enthusiastic when caution would be more advisable and to be over-conservative when a little enthusiasm would be productive of good results.

In so far as employment is concerned, the most difficult period is still to come. It is believed that every effort will have to be exerted if the first three months of the new year are passed without some distress among wage-earners. In that connection, it is suggested that manufacturers can do much to tide over these months by replacing obsolete equipment and in a general overhauling of their plants. A survey now in progress by the Department of Commerce, while not complete, has revealed a surprising amount of obsolete equipment in manufacturing plants. A knitting machine that was purchased second-hand 50 years ago still is in operation today in one plant. There are a surprising number of instances where machinery is 60 per cent or more obsolete. Some of these machines require the services of nine men where one man could operate a machine of the same capacity of the type produced today. By modernizing plants at this time, manufacturers would contribute to the employment situation and would benefit in the long run themselves. If all will co-operate, it is believed that the country can be pulled out of this depression more rapidly than ever was the case before.

The movement instigated by President Hoover is looked upon as a great economic experiment. An effort is being made to demonstrate whether or not unity of action and co-operation can overcome the business cycle. If the experiment succeeds, it will be a great event in economic history.

* * *

Foundry Equipment Orders Drop Off

In line with the declines resulting from the first stock market scare in most fields, the index of foundry equipment orders, as reported by 20 major manufacturers, dropped off 50 per cent. The index was 128.6 for November, 245.3 in October, and 197.8 for November, 1928. The index of unfilled orders also fell off slightly, being now 445.4, as compared with 492.5 for October, and 403.9 in November, 1928. The index of shipments dropped to 152.2, as compared with 214.1 for October, and 264 for November of last year. All figures are on a basis of average monthly shipments for 1922-24 considered as 100.

Westinghouse to Build $1,500,000 Laboratory

An expenditure of $1,500,000 will be made by the Westinghouse Electric & Manufacturing Co. in the construction of a central engineering laboratory and an addition to the present d.c. power laboratory, both in East Pittsburgh. The new laboratory will eventually replace numerous small ones now scattered throughout the plant, and will also combine a number of test sections. It will be 11 stories in height, 90x225 feet.

Business Items

The Carthage Machine Company of Canada, which has been operated and controlled by the parent company in Carthage, N. Y., will hereafter have its head office in Belleville, Ont. Messrs. Wardell and Hinds of Watertown, N. Y., respectively manager and president of the American company, recently disposed of their stock to a group of Belleville capitalists. The new officers are: President, R. J. Graham; secretary-treasurer, F. S. Wilson; manager, W. R. Tidmarsh.

General sales offices, through which all business is to be transacted between the Cleveland head office and Canadian and British distributors, have been opened in St. Catherines, Ont., by Thompson Products, Ltd. Vincent E. Crawford, general manager of the Toledo Steel Products Co. for the past 11 years, has assumed the duties of vice-president and general manager of the Thompson plant at St. Catherines.

Work has been started upon the $350,000 addition to the Monarchs Tractor plant of the Allis-Chalmers Manufacturing Co., Springfield, Ill., north of the present tractor plant. The new unit will have 63,000 sq.ft. of floor space and will serve as a warehouse. The work is expected to be completed in three months.

The General Steel Castings Corporation has arranged to purchase the steel foundry of the American Locomotive Co., Chester, Pa., and the Thurlow Steel Foundry of the American Steel Foundries Co., also at Chester, Pa. The plants are near Eddystone, Pa., where the General Corporation is building a large plant adjacent to the Baldwin Locomotive Works.

The Hamilton Metalplane plant is to remain at Milwaukee indefinitely, notwithstanding announcements made by the United Aircraft & Transport Co., of which the Hamilton concern is a subsidiary, that it would be consolidated at Wichita, Kan., with the plant of the Stearman Aircraft Co., another subsidiary. Decision of the United officials not to move the Hamilton plant immediately, according to Charles F. Barndt, Hamilton plant manager, hinged largely on the fact that the Wichita plant was not equipped to manufacture metal airplanes. A carload of machinery from the Hamilton Metalplane and the Hamilton Aero Manufacturing Co. plants in Milwaukee, besides some new equipment purchased in Milwaukee, has been shipped to the Hamilton Aero Co. service plant at Burbank, California.

The Paper Textile Machinery Co., Sandusky, Ohio, has been sold to a group of leading paper manufacturers of the United States, according to W. H. Millspaugh, president of the Sandusky concern. Millspaugh, an inventor, founded the company about ten years ago to manufacture his invention. No immediate changes are planned.

Julius Andrae & Sons Co., Milwaukee, Wis., electrical equipment wholesaler controlled by the Westinghouse Electric & Manufacturing Co., Pittsburgh, for the past five years, on Jan. 1 will adopt a new title, The Westinghouse Electrical Supply Co., Inc. Henry P. Andrae, son of the founder, remains as president and treasurer. J. C. Schmidtbauer is vice-president and secretary.

Permanent distribution and service headquarters for LeBlond Aircraft Motors have been established in the hangar of the Angelus Aero Corporation, Los Angeles Metropolitan Airport, according to a recent announcement made by C. C. Ludlow, Pacific Coast distributor for the LeBlond Corporation.

The Manganese Steel Forge Co., Philadelphia, has discontinued its Cleveland office and the Cleveland district hereafter will be handled by J. H. McKinley, manager of the Pittsburgh office. C. M. Hobbs, formerly in Cleveland, now has charge of the Chicago office.

The General Manufacturing Co., Detroit, Mich., has appointed John M. Davie as representative in Western Pennsylvania and Northern Ohio, excepting Toledo and suburbs. Mr. Davie's headquarters will be at 2453 Overlook Road, Cleveland Heights, Ohio.

The Reeves & Skinner Machinery Co., St. Louis, Mo., has been appointed representative of the American Fluid Motors Co., Philadelphia, to handle the sale of Hele-Shaw pumps in Missouri and the southern half of Illinois.

The Berkley Tool & Manufacturing Co., Berkley, Mich., has been incorporated to manufacture and deal in parts, tools, and dies.

The Relay Motor Truck Corporation of Illinois, Chicago, has been incorporated to manufacture and deal in motors and machinery.

The New York sales office of the Reed-Prentice Corporation, Worcester, Mass., has been moved to 41 Broad Street.

L. F. Serrick, Inc., Defiance, Ohio, has been incorporated with $100,000 capital to manufacture machinery and screw-machine products.

Personals

FRANK PURNELL was elected president of the Youngstown Sheet & Tube Co., Youngstown, Ohio, at a meeting of the board of directors on Dec. 3. He succeeds James A. Campbell, who becomes chairman of the board of directors. Mr. Campbell will continue to have general direction of the company's affairs. Mr. Purnell, at the age of 43, is one of the youngest steel company executives in the country. He started his career in the industry in 1902 as a hall boy for the Sheet & Tube company. After serving that company for 15 years, he was loaned in August, 1917, to the war industries board at Washington. In 1919, Mr. Purnell was named vice-president of the Consolidated Steel Corporation, New York, which handled the export business for a group of leading independent steel companies. In 1922, he was elected vice-president of the Bethlehem Steel Corporation, in charge of its export division. Mr. Campbell recalled him in 1923 to the Sheet & Tube company as a vice-president. On Jan. 1, 1927, he was made assistant president.

E. O. SHREVE, manager of the industrial department of the General Electric Co., Schenectady, N. Y., has been appointed assistant vice-president on the staff of vice-president J. G. Barry, according to an announcement made recently by Gerard Swope, president. WILLIAM W. MILLER, assistant manager of the industrial department, has been appointed manager to succeed Mr. Shreve.

E. F. MARRESFORD, formerly with the American Machine & Foundry Co., has been appointed to the sales staff of The Watson-Stillman Co., 75 West St., New York.

W. H. VANVLECK has resigned as New York district sales manager of the Alan Wood Steel Co., Conshohocken, Pennsylvania.

L. A. FIELDS, in charge of sales, Solon Grinding Co., Seattle, Wash., has been transferred to the Seattle plant as assistant manager, to succeed M. H. Bertenshaw.

BERTRAM G. PARKER has been elected president of the Youngstown Foundry & Machine Co., Youngstown, Ohio, to succeed W. J. WALLIS, who becomes chairman of the board of directors. Mr. Parker has been with the company 31 years and for the past 8 years has been vice-president and general manager. Mr. Wallis has been head of the company 40 years.

RAY M. HUDSON, assistant director of the U. S. Bureau of Standards in charge of the commercial standards division, has resigned. He will begin new duties as secretary of the Massachusetts Division of the New England Council on Jan. 2, 1930, with headquarters in Boston, Mass. Ever since his graduation from Syracuse University in 1908, Mr. Hudson has devoted his efforts to the study of simplification, standardization, and scientific management methods. He has been a frequent contributor to technical, trade, and business magazines, and has prepared the section on simplification and standardization for two successive editions of the Encyclopedia Britannica.

D. A. HIENS, manager of the Roderick Lean plant, Mansfield, Ohio, was selected as general manager of the four plants operated by the Vulcan Plow Co., including Mansfield and Evansville, as well as the Hayes Pump & Planer Co., Galva, Ill., and the Peoria Drill & Feeder Co., Peoria. He was also made treasurer. Edwin M. Eichen is now assistant secretary and treasurer. Dr. Allen Kanavel is secretary.

R. G. HOLMES, Detroit representative of Putnam Machine Tools, manufactured by Manning, Maxwell & Moore, Inc., with offices at General Motors Building, has severed his connections with the above company. J. H. WELCH of the same office will carry on his work for the Detroit district.

ADOLPH VOLDERAUER, secretary and general sales manager of the Vulcan Plow Co., Evansville, Ind., has been named vice-president to succeed the late G. Arthur Trimble. Mr. Volderauer also becomes general manager of the Evansville plant.

ERWIN E. DRESSE, chief engineer for the past year of the Lincoln Electric Co., Cleveland, has been appointed professor of electrical engineering, Ohio State University, Columbus, Ohio, effective Jan. 1.

ARTHUR HUGHES, president of the Hughes-Keenan Co., Mansfield, Ohio, has been made president of the recently re-organized Superior Body Corporation. This does not involve a merger of the two companies.

GEORGE L. BOURNE, recently elected chairman of the executive committee of the International Combustion Engineering Corporation, New York City, is also president of the Superheater Co. The two companies have not merged.

H. J. MOUAT, 1116 Martin Bldg., Birmingham, Ala., has been appointed southern district representative of the Clark Controller Co., 1146 East 152d St., Cleveland.

LOUIS BERG, formerly manager of manufacturing for the AC Spark Plug Co., Flint, Mich., and with the company for the past 12 years, has been named works manager.

FRANK A. SEEDLOCK, for many years superintendent of the Vixen Tool Co., Newark, N. J. and Newcomerstown, Ohio, has accepted a similar position with Filecraft, Inc., Cleveland, Ohio.

ARTHUR W. M. GREEN, formerly sales metallurgist for the Poldi Steel Corporation of America, Philadelphia, has been appointed manager of the tool-steel division of the Edgecomb Steel Co., Philadelphia, handling the product of the Vanadium Alloys Steel Co., Latrobe, Pa. Prior to his affiliation with the Poldi Corporation, he was metallurgist for the John Illingsworth Steel Co., Philadelphia, for more than 12 years. At one time he was connected with W. B. Coleman & Co., Philadelphia, as steel consultant.

F. A. MITCHELL, secretary and general manager of the Irwin Auger Bit Co., Wilmington, Del., resigned recently after having been affiliated with the company since 1913.

WILLIAM C. WHITNEY, Winchendon, Mass., has been made a director of the Yates-American Machine Co. Mr. Whitney is president of Baxter D. Whitney & Son, Inc., Winchendon.

WALKER M. LEAVETT, Clinton, Conn., has been appointed general manager of the Welker-Hoops Co., Middletown, Connecticut.

Obituaries

JOHN MORRISON HANSON, president and chairman of the board of directors of the Standard Steel Car Co., Pittsburgh, died on Dec. 13 in La Rochelle, France. Mr. Hanson was born in Butler County, Pa., and had been a resident of the Pittsburgh district all his life. He was a graduate of the Western University of Pennsylvania and was formerly chief engineer of the Pressed Steel Car Co. He was chosen president of the Standard Steel Car Co. in 1902 upon its formation, and later became chairman of the board.

GEORGE G. HORNUNG, superintendent of the can department of the Larkin Co., and founder of the largest can works in Buffalo, purchased later by the Larkin Co., died on Dec. 15 at his home in Buffalo. He was 73 years of age.

JACOB E. MESTA, affiliated with the sales department of the Mesta Machine Co., Pittsburgh, died on Dec. 19 in that city. He had been associated with the company for 25 years.

WILLIAM H. REA, former treasurer of the Mesta Machine Co., Pittsburgh, died on Dec. 15 at his home in that city. He was 73 years of age.

DAVID MILLER, founder and president of the D. Miller Scrap Iron Co., Green Bay, Wis., died on Dec. 9. He was 79 years of age.

Forthcoming Meetings

AMERICAN ENGINEERING COUNCIL—Annual Meeting, Washington, D. C., Jan. 9 to 11. L. W. Wallace, 26 Jackson Place, Washington, is secretary.

AMERICAN SOCIETY OF STEEL TREATERS—Semi-annual meeting, Hotel Pennsylvania, New York City, Feb. 7 and 8, 1930. W. H. Eisenman, 7016 Euclid Ave., Cleveland, is secretary.

THE WEEKLY PRICE GUIDE . . .

Rise and Fall of the Market

FOUNDRY, No. 2, iron is up 50c. per ton, to $15, at Birmingham, marking the first advance since June. Considerable quantities of iron are being taken by foundries in anticipation of an active spring demand for water pipe. Steel is experiencing the usual year-end buying lull. Prices continue to hold, however, on finished steel despite a downward tendency in semi-finished material. Black steel sheets dropped 10c. per 100 lb., to $3.90, base, at New York; slab zinc is off 0.3c. per lb., to 5.5c., at East St. Louis. Higher prices are being asked for scrap red brass and linseed oil.

(All prices as of Dec. 20, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$17.69@$18.19
Northern Basic	19.90
Southern Ohio No. 2	19.90
NEW YORK—Tidewater Delivery	
No. 2 Southern (silicon 1.75@2.25)	19.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15 00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76@22 26
Virginia No. 2	24 04
Basic	19.75@20.25
CHICAGO	
No. 2 Foundry, local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	20.01
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20 26
Basic	20 26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.30	3.90†
No. 12	2.15@2.25	3.45	3.35	3.95†
No. 14	2.25@2.35	3.55	3.45	4.00†
No. 16	2.35@2.45	3.65	3.55	4.10†
Black				
Nos. 18 to 20	2.55	3.85	3.70	3.70
No. 22	2.70	4.00	3.85	3.85
No. 24	2.75	4.05	3.90	3.90
No. 26	2.85	4.15	4.00	4.00
No. 28	3.00	4.75	4.15	4.15
Galvanized				
No. 10	2.70@2.80	4.20	4.05	4.05
Nos. 12 to 14	2.80@2.90	4.30	4.15	4.15
No. 16	2.90@3.00	4.40	4.25	4.25
No. 18	3.05@3.15	4.55	4.40	4.40
No. 20	3.20@3.30	4.70	4.60	4.55
No. 22	3.25@3.35	4.75	4.65	4.60
No. 24	3.40@3.50	4.90	4.75	4.75
No. 26	3.65@3.75	5.15	5.00	5.00
No. 28	3.90@4.00	5.40	5.25	5.25

*Light plates. †Up to 3,999 lb

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt	53.74%	41.2%	55.5%	43.5%	55.5%	42.5%
3½ to 6 in. lap	50.32%	37.78%	53.5%	40.5%	51.6%	39.0%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness—Decimal Fractions	B.w.g. and	Outside Diameter in Inches—⅛	¼	⅜	½	⅝	¾	⅞
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.25	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; ¼, 7.85c. per lb.; $\frac{5}{32}$ to ½, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			41.50@42.50
Lead, pigs, E. St. Louis	6.10	New York	7.00@ 7.50
Zinc, slabs, E. St. Louis	5.50	New York	7.00@ 7.50

	New York	Cleveland	Chicago
Antimony, slabs	10.50@11.00	11.60	14.50
Copper sheets, base	27.75	27.75	27.75
Copper wire, base	20.12½	20.12½	20.12½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25@26	24.30	24.30
Zinc sheets (casks).....	10.75@11.25	12.25	10.11
Solder (½ and ½).....	29.50	29.75	28@30
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			56.50
Commercial genuine, intermediate grade.....			42.00
Anti-friction metal, general service.....			31.00
No. 4 babbitt.....			11.50

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold drawn.....	53.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper.....	14.25 @14.75	13.50	12.00 @12.50
Copper, heavy, and wire..	13.50 @13.75	13.00	11.00 @12.00
Copper, light, and bottoms	12.00 @12.25	12.00	10.00 @11.00
Heavy lead.....	4.50 @ 5.00	5.25	4.25 @ 4.75
Tea lead.....	2.87½@ 3.12½	3.25	3.25 @ 3.75
Brass, heavy, yellow.....	7.75 @ 8.00	8.00	7.00 @ 7.50
Brass, heavy, red.....	11.00 @11.50	12.50	10.00 @10.50
Brass, light.....	6.25 @ 6.75	7.00	6.00 @ 6.50
No. 1 rod-brass turnings..	9.00 @ 9.25	8.00	7.50 @ 8.00
Zinc.....	2.50 @ 3.00	3.00	2.50 @ 3.00

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb..	$0.13*	$0.16	$0.15
Cotton waste, colored, per lb..	.09½*	.12	.12
Wiping cloths, washed, white, per lb.....	.12½	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.028	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.159	.164	.166
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.65	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.24
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt..	30%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*Grade F.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.035	.035	.034
Brass rods.....	per lb..	.2125	.2125	.1825
Solder (½ and ½).....	per lb..	.295	.2975*	.35
Cotton waste, white...	per lb..	.13	.13	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	4.59	4.59	3.59
Lard cutting oil.....	per gal.	.65	.65	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*.....	$6.03	$6.03	$6.03
Emery cloth*.....	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†.....	2.61	2.61	2.61
Cloth†.....	4.59	4.59	4.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton.....	Connellsville,		2.65
Coke, prompt foundry, per net ton.....	Connellsville,		3.50@4.85
White lead, dry.....	100 lb. kegs ...	New York,	13.75
White lead, in oil.....	100 lb. kegs....	New York,	14.25
Red lead, dry.....	100 lb. kegs....	New York,	13.75
Red lead, in oil.....	100 lb. kegs....	New York,	15.25

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, $\frac{7}{16}$-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Mich., Detroit—Master Tool & Die Co., 3155 East Willis St.—one milling machine and equipment.

Mich., Detroit — Pressed Steel Engineering Co., 8211 Collins St.—planer.

Ont., Sandwich—Sandwich Foundry, Ltd., 400 Bloomfield St.—cupolas and general equipment for 1 story foundry to replace fire loss. $250,000.

Opportunities for Future Business

Ala., Birmingham—Southern Wheel Co., 700 Sixth Ave. S., manufacturers of car wheels, awarded contract for the construction of a 1 story, 60 x 80 ft. machine shop. Estimated cost $25,000 including equipment.

Calif., Oakland—Eureka Mill & Lumber Co., 3615 East 14th St., plans the construction of a planing mill at East 10th St. and 38th Ave. Estimated cost $10,000.

Calif., Sacramento—Southern Pacific Co., 65 Market St., San Francisco, plans to expend $1,857,355 for extensions and improvements, including new equipment and improvements to shops, six new locomotives, etc., here. G. W. Boschke, San Francisco, Ch. Engr.

Calif., San Francisco — Schlage Lock Co., 20 Bayshore Ave., awarded contract for the construction of a factory annex at Bayshore Ave. Estimated cost $15,000.

Conn., Bridgeport — Southern New England Telephone Co., 157 Church St., New Haven, is having plans prepared for the construction of a 1 story, 100 x 200 ft. garage at Charles and Federal Sts., here. Estimated cost $100,000. R. Foote, 185 Church St., New Haven, Archt.

Conn., Hartford — L. White, 88 Westerly Terrace, awarded contract for the construction of a 1 story, 75 x 125 ft. sales and service garage. Estimated cost $42,000. Ebbets & Frid, 15 Lewis St., Archts.

Conn., Meriden—International Silver Co., J. A. Hutchinson, 48 State St., plans addition to factory E. Estimated cost $50,000. Private plans.

Conn., New Haven—G. & O. Mfg. Co., 138 Winchester Ave., manufacturers of airplane radiators, awarded contract for the construction of a 2 story, 40 x 100 ft. factory on Winchester Ave. Estimated cost $40,000. Noted Dec. 12.

Ill., Chicago—Laurie Mfg. Co., O. C. Keckley, Pres., 565 Washington Blvd., manufacturers of hydraulic presses and pumps, plans a large expansion program in 1930, in plant equipment, also in the manufacture of new lines of industrial equipment.

Ill., Chicago — Naylor Pipe Co., 1230 East 92nd St., manufacturers of iron pipe, etc., awarded contract for the construction of a 1 story, 70 x 198 ft. addition to factory. Estimated cost $35,000, including equipment.

Ill., Chicago — Pheoll Mfg. Co., 5700 West Roosevelt Rd., manufacturers of machine screw products, will soon award contract for a 3 story, 80 x 300 ft. addition to factory at Roosevelt Rd. and Waller Ave. A. S. Alschuler, 28 East Jackson Blvd., Archt.

Md., Baltimore — St. Paul Garage Co., c/o A. P. Strobel, 812 North Charles St., will soon award contract for the construction of a 7 story, 190 x 195 ft. garage at St. Paul and Saratoga Sts. Estimated cost $750,000. Wyatt & Nolting, Keyser Bldg., Archts., Van R. P. Saxe, 217 North Calvert St., Engr.

Mass., Abington—Angrley Bros., Washington St., plans the construction of a repair and service garage at Bedford St. and Brickton Ave. Estimated cost $40,000. Private plans.

Mass., Beverly—Reid Bros., Park St., awarded contract for the construction of a 1 story, 60 x 200 ft. machine shop at Dock Lane near Elliott St.

Mass., Everett — Standard Mailing Machine Co., Revere Beach Parkway, awarded contract for addition and alterations to factory. Estimated cost $40,000.

Mass., Lowell—Marden & Murphy, Inc., 17 Jackson St., will soon award contract for the construction of an automobile repair and service garage on Jackson St. Estimated cost $50,000. H. E. Byam, 45 Merrimack St., Engr.

Mass., Watertown — J. W. Greer Co., 119 Windsor St., Cambridge, manufacturers of confection and biscuit machinery, awarded contract for the construction of a 2 story, 80 x 500 ft. factory here. Estimated cost $40,000.

Mich., Port Huron—City plans the construction of an airport development including hangars, machine shop, etc. Estimated cost $75,000. E. R. Whitemore, City Hall, Engr.

N. J., Jersey City—Indalite Lamp Shade Co., 836 Broadway, New York, plans the construction of a 4 story addition to plant at 49 Fremont St. Estimated cost to exceed $40,000.

N. J., Newark—Positive Lock Washer Co., Ave. A., will soon award contract for a 2 story addition to factory for the manufacture of lock washers. Estimated cost $40,000. R. B. Flatt, 600 Bloomfield Ave., Bloomfield, Archt. Noted Dec. 19.

N. J., Passaic—Owner, c/o F. P. Friedman, 395 Springfield Ave., Newark, Archt., is having preliminary plans prepared for the construction of a 1 story, 140 x 150 ft. garage and repair station here. Estimated cost $150,000.

N. J., Secaucus—New York Air Terminal Inc., W. F. Carey, Pres., 825 8th Ave., is having preliminary plans prepared for the construction of a 1 and 2 story airport, including hangar, machine shop, etc., here. Estimated cost $1,000,000.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

N. Y., Astoria — Daljo Corp., 31-11 Grand Ave., will soon receive bids for the construction of a garage at 10th and Wilson Sts.

N. Y., Brooklyn — Brooklyn Gas Co., 1721 Sheepshead Bay Rd., plans the construction of a storage and distribution plant, including mechanical shop, automobile repair and service garage, etc., at 805-33 Neptune Ave. Estimated cost $275,000. Bloch & Hesse, 18 East 41st St., New York, Archts. C. E. Smith, 116 West 39th St., New York, Engr.

N. Y., Brooklyn — I. Kallich, 26 Court St., Archt., will soon receive bids for an automobile repair and service garage at Coney Island Ave. and Quentin Rd. Estimated cost $130,000. Owner's name withheld.

N. Y., Elmhurst—Cord Meyer Co., 43-37 91st Pl., will build addition to garage at 88th St. and Roosevelt Ave.

N. Y., Endicott—International Business Machine Co., will receive bids after Feb. 1, for the construction of a factory.

N. Y., Flushing—Prisco & Sorerio, Inc., 113-04 205th St., will build a garage at Northern Blvd. and 159th St.

N. Y., Long Island City—Nash-Queens Motor Co., 94-30 Merrith Rd., will soon receive bids for the construction of a garage.

N. Y., Long Island City—T. J. Rumney, 81 Hancock Pl., awarded contract for the construction of a 1 story, 50 x 120 ft. welding shop at Hancock St. and 43rd Rd.

N. Y., New York—C. E. Appleby, 17 John St., plans the construction of a 90 x 117 ft. factory, blacksmith shop, etc. at 602 West 40th St. Estimated cost $200,000. R. C. Clark, 491 West 39th St., Archt.

N. Y., New York—R. Hoe & Co., 138th St. and East River, plans the construction of a 3 story press manufacturing plant at Walnut and 137th Sts. Estimated cost $125,000. F. S. Parker, 119 West 57th St., Archt.

N. Y., New York—H. Neiberg, 138 Ludlow St., will receive bids about Jan. 1 for the construction of a 3 story garage, etc. Estimated cost $60,000. M. Margolin, 105 Court St., Brooklyn, Archt.

N. Y., New York—Risbach Realty Co., H. F. Fischbach, Pres., 226 East 41st St., plans the construction of a 5 story, 75 x 100 ft. garage at 329 East 21st St. Estimated cost $150,000. H. Ginsberg, 205 East 42nd St., Archt.

N. Y., Port Richmond — United Dry Docks, Inc., Mesereau Ave. and Davidson St. will build a 120 x 400 ft. foundry and shop. Estimated cost $80,000.

N. Y., St. George—Dept. of Parks, New York, plans the construction of a 2 story, 75 x 136 ft. shops, etc. at Slosson and Drake Aves., here. Estimated cost $50,000. Sibley & Fetherstone, 205 East 42nd St., New York, Archts.

N. Y., St. George — Dept. of Water, Gas & Electricity, New York, plans the construction of a 42 x 73 ft. garage and repair shop at Ontario Ave. and Victory Blvd., here. Estimated cost $60,000. Sibley & Fetherstone, 200 East 42nd St., New York, Archts.

N. Y., St. George — Otto F. Koehler, Inc., Wagner College, will build a 3 story, 80 x 120 ft. garage at Monroe Ave. and Fort Pl. Estimated cost $90,000. Maturity summer 1930.

O., Cincinnati—Cincinnati Steel Castings Co., Spring Grove Ave., will soon award contract for the construction of a 1 story, 90 x 290 ft. factory. Estimated cost $110,000.

Pa., Ambridge—American Bridge Co., R. F. Ball, Secy., Frick Bldg., Pittsburgh, will build a 1 story, 290 x 350 ft. standard beam shop. Estimated cost $1,500,000. Private plans.

Pa., Ambridge — National Electric Products Co., N. C. Lamont, Gen. Mgr., 14th St., will build a 1 story, 125 x 180 ft. manufacturing plant at 14th and Duss Sts. Estimated cost $50,000. S. F. Mali, 14th St., Engr.

Pa., McKeesport — Columbia Radiator Co., F. C. Painter, Secy. and Treas., 3200 Walnut St., awarded contract for the construction of a 1 story, 100 x 450 ft. foundry, machine shop and warehouse. Estimated cost $250,000. Noted Nov. 26.

Pa., Pittsburgh — Dravo Contracting Co., Neville Island, plans to expend $750,000 for expansion program including steel storage yard with crane facilities to handle 50 per cent additional shop capacity, also work under way on addition to structural shop building to permit installing extensive shear and punch equipment at Neville Island plant; work under way on complete outfitting dock with necessary shop facilities at Christina River yard, Wilmington, Del.

Pa., Pittsburgh — Firestone Tire & Rubber Co., 1286 South Main St., Akron, O., awarded contract for the construction of a 3 story, sales and service station on Baum Blvd. Estimated cost $250,000. Noted Dec. 5.

Pa., Pittsburgh—Reliance Steel Castings Co., 28th and Smallman Sts., had plans prepared for the construction of a foundry and office. Estimated cost $50,000. Lake & Davidson, Negley Bldg., Archts.

Tex., Houston—Ford Motor Co., 3906 Harrisburg Blvd., awarded contract for the construction of a 2 story, 35 x 75 ft. branch factory and assembly plant. Estimated cost $45,000.

Wis., Green Bay—John Hoell & Co., 7225 Roosevelt St., plans the construction of a 1 story, 40 x 60 ft. machine shop.

Wis., Green Bay—Nelson Machine Co., 131 North Pearl St., plans a 1 and 2 story, 35 x 81 ft. addition to factory.

Ont., Sudbury — International Nickel, J. Lacnew, Mgr., plans the construction of a crusher plant and transformer building destroyed by fire. Plans to re-equip immediately. $250,000.

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AMERICAN MACHINIST

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Editorial Staff, GEORGE S. BRADY FRANK J. OLIVER, JR. *(Chicago)*, CHESTER B. LORD, W. W. DODGE
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Enameling Stove Parts in the Modern Manner 1047

By R. N. Detzer. *Mass production methods and controls have been applied successfully to an industry badly in need of this application*

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There are very many opportunities for first class investments right out in your own shop.

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Why scan bond lists for good, sound investments that will give you 5%, when there are more opportunities for much larger profits by investing in modern

MACHINE TOOLS

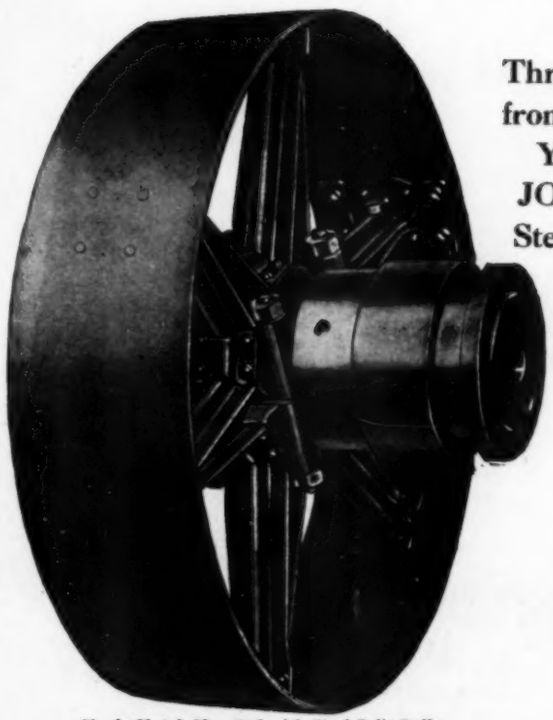
The Master Tools of Industry

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION

THE JOHNSON FRICTION CLUTCH

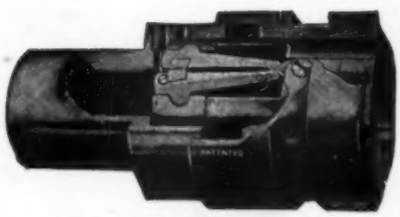
RELIABLE CLUTCHES!

THAT *Is What* JOHNSONS ARE



Single Clutch Mounted with Steel Split Pulley

Thruout the World from Shop to Shop You will Find JOHNSONS Use Steadily Growing

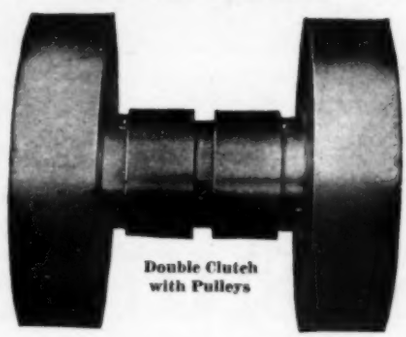


Single Clutch, Sectioned, Showing Working Parts

It is quite customary to get 10- 15- 20- years' service from JOHNSON Clutches.

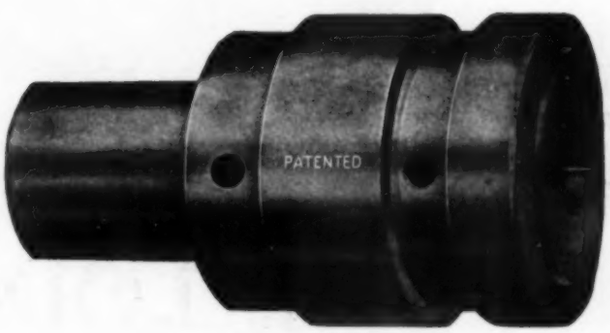
One of our users said that they believed JOHNSON Clutches were rather bearing on the market, they lasted so long.

You should use JOHNSONS—Fleet as a bird on the start—Certain as time in performance—Quick as a flash on the stop.



Double Clutch with Pulleys

To Know More About This Clutch Which Lasts So Long



Single Clutch, Exterior

WRITE FOR CATALOG "BLUE—124"

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

THE LODGE & SHIPLEY
CINCINNATI,

Between these covers
Is a Modern Lathe Story

BETWEEN the covers of this booklet is information of interest to every alert shop superintendent, production executive, and foreman.

Pertinent facts as to the design, construction and operation of Lodge & Shipley Triple Geared Lathes are told in concise form.

Get a copy of this booklet before you—look it over and find out for yourself those points in design and features of construction that make this a profitable machine in your shop five—ten—fifteen years after installation.

A copy will be sent by return mail at your suggestion. Ask for "Lathes of Power" Booklet or stick the attached coupon to your letterhead and send it to us.

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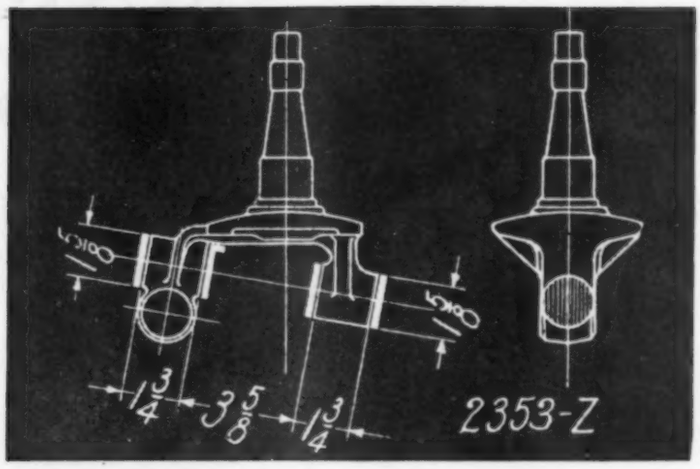
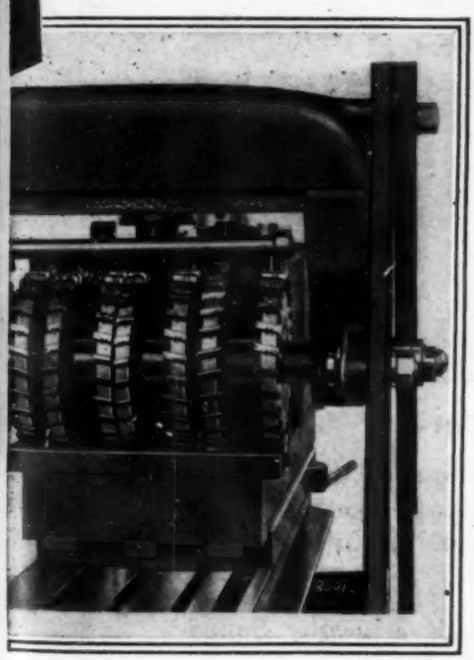


LOCKED..... HYDRAULIC FEED

PREVIOUSLY this job was handled on a highly productive feed miller, but by placing it on the HYDROMATIC, with its exclusive HYDRAULIC FEED, PRODUCTION WAS INCREASED 125%. While the former production was GOOD, Hydromatic production is tremendously BETTER. The production obtained is limited by the handling time—the machine has capacity to give still further production increase.

This case is typical. Enthusiasm based upon initial installations brings repeat orders. A multitude of advantages accompanies the use of the Hydromatic. Cold facts on performance are significant to prospective buyers of production milling machines.



Consider the following additional advantages which this installation produced—

1. **Increased Cutter Life.**
2. **Index Base Method saved time.**
3. **Tremendous power and rigidity made possible the use of large gang of eight cutters.**
4. **Better finish obtained.**
5. **Less work spoiled.**
6. **Labor costs lowered.**

Today production jobs can best be handled on a machine with automatic features. Every Hydromatic has dog-controlled, intermittent hydraulic table feed. You get exclusive, profit-making features *at no extra cost*. The flexibility of the Hydromatic is unequalled. It is ideal for high quantity production and for small lots as well. GET PERFORMANCE FACTS ON THE HYDROMATIC!

THE CINCINNATI MILLING MACHINE COMPANY
CINCINNATI, OHIO, U. S. A.

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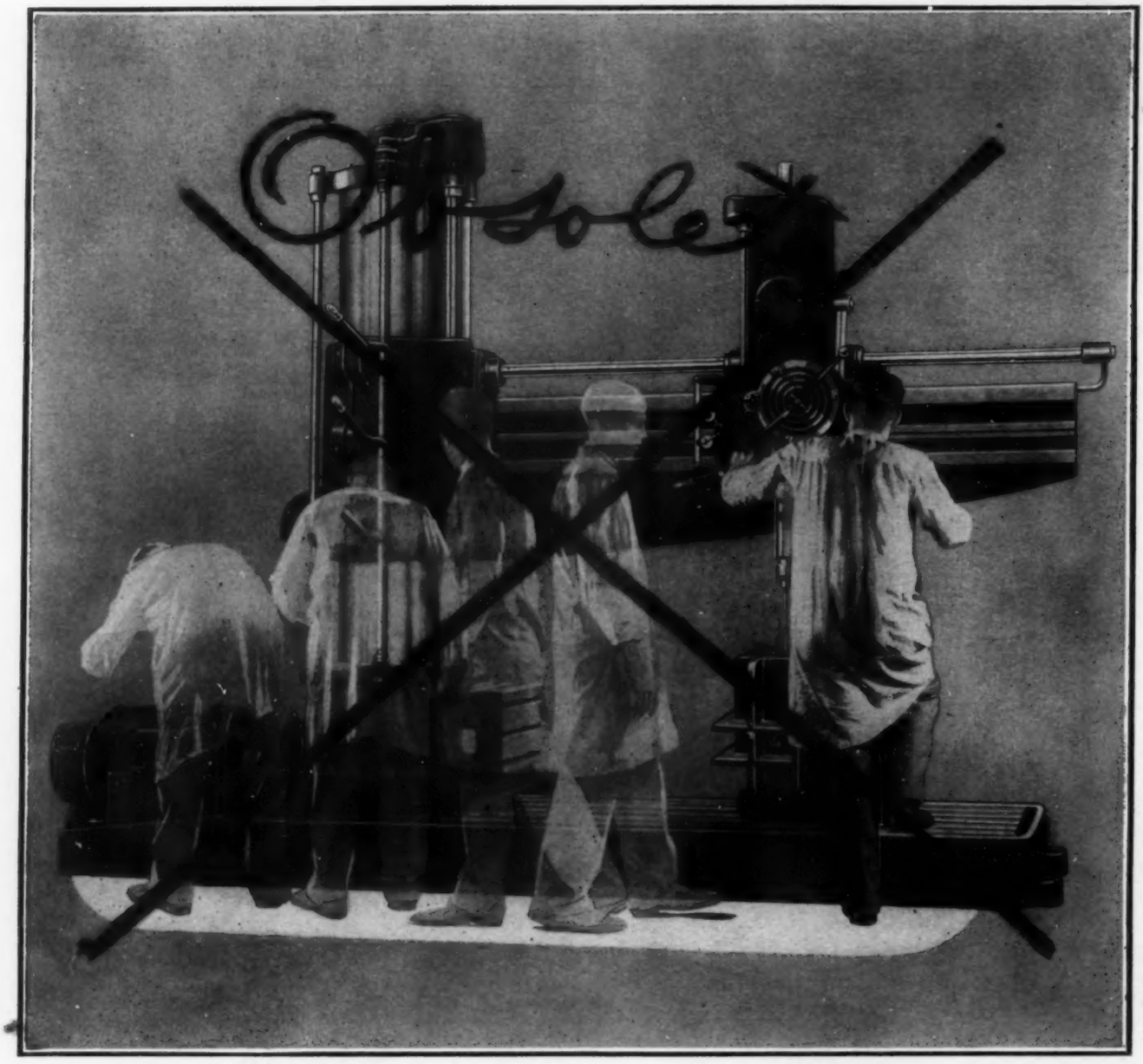
Eliminate Footwork



AN OLD-STYLE RADIAL—REMOTE CONTROL

Time spent in getting ready to drill—in walking from one end of the machine to the other to change speeds or clamp the column—doesn't get the holes drilled. Eliminate this needless waste of time and energy by installing Super-Service Radials.

Replacing old-fashioned radials of the scattered control type with the Super-Service has effected savings of from 30 to 50%. Write for "Proof."

THE CINCINNATI BICKFORD TOOL

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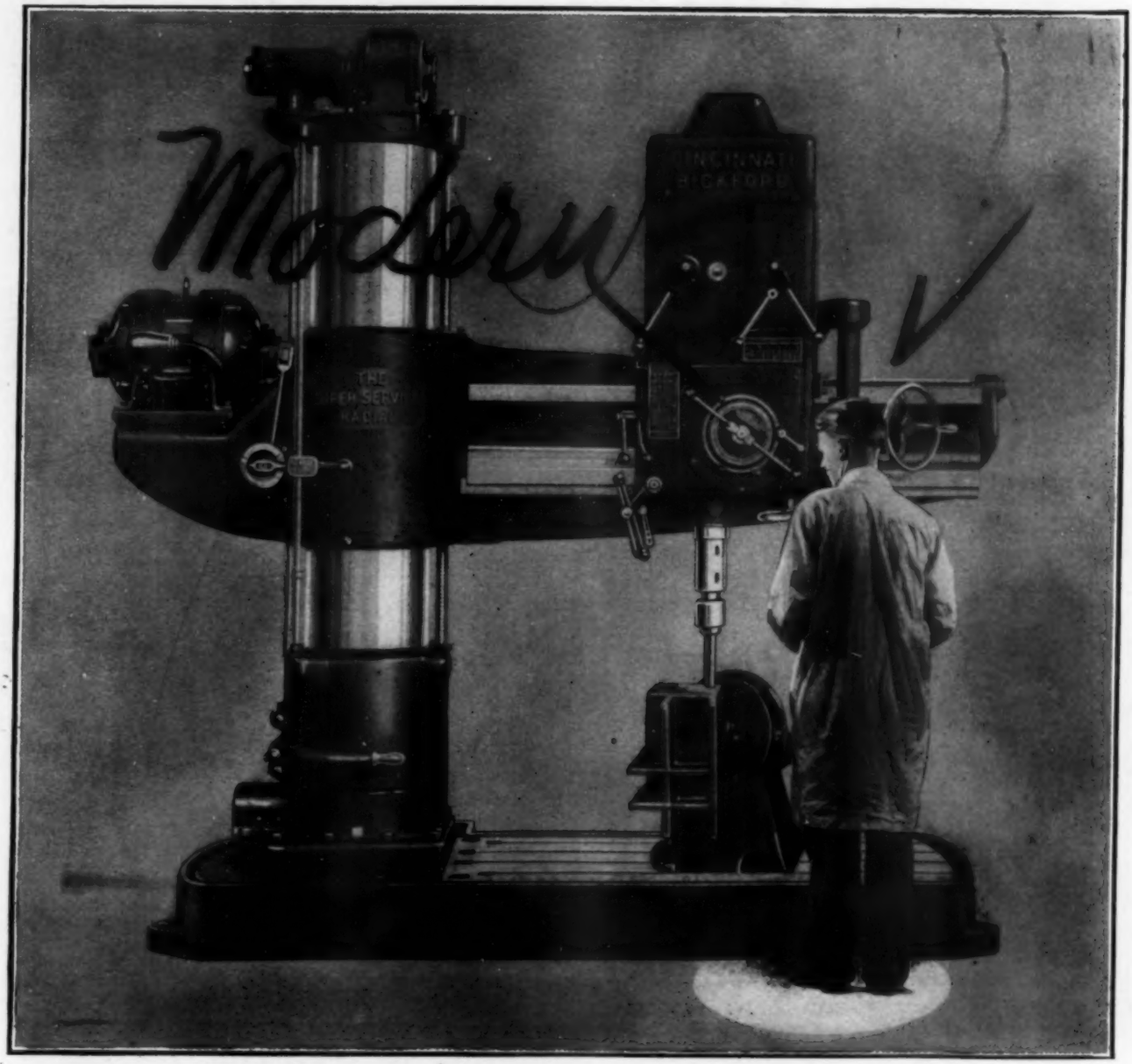
From Radial Drill Operation



THE SUPER-SERVICE RADIAL—CENTRALIZED CONTROL

All speed and feed changes made instantly at the operating position saves walking back and forth from one end of the machine to the other.

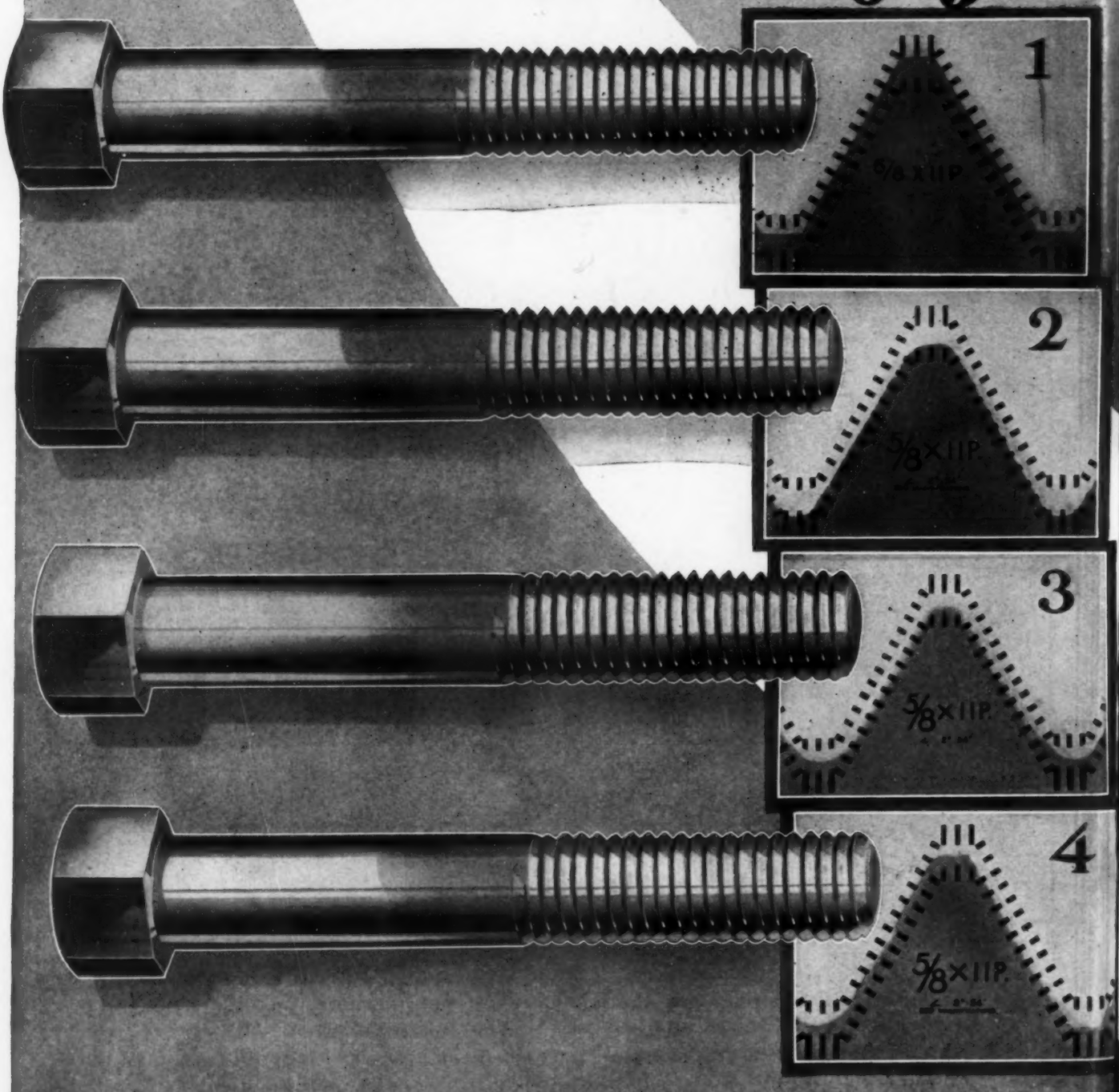
Power Column Clamping controlled at the head saves two round trips between column and spindle for each hole drilled.

Power Rapid Traverse eliminates slow hand cranking, and saves time in spotting the drill.

You should have a complete description of this machine. Write for the catalog today.

COMPANY, OAKLEY, CINCINNATI, OHIO.

They all look alike—
how do they fit?



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J&L
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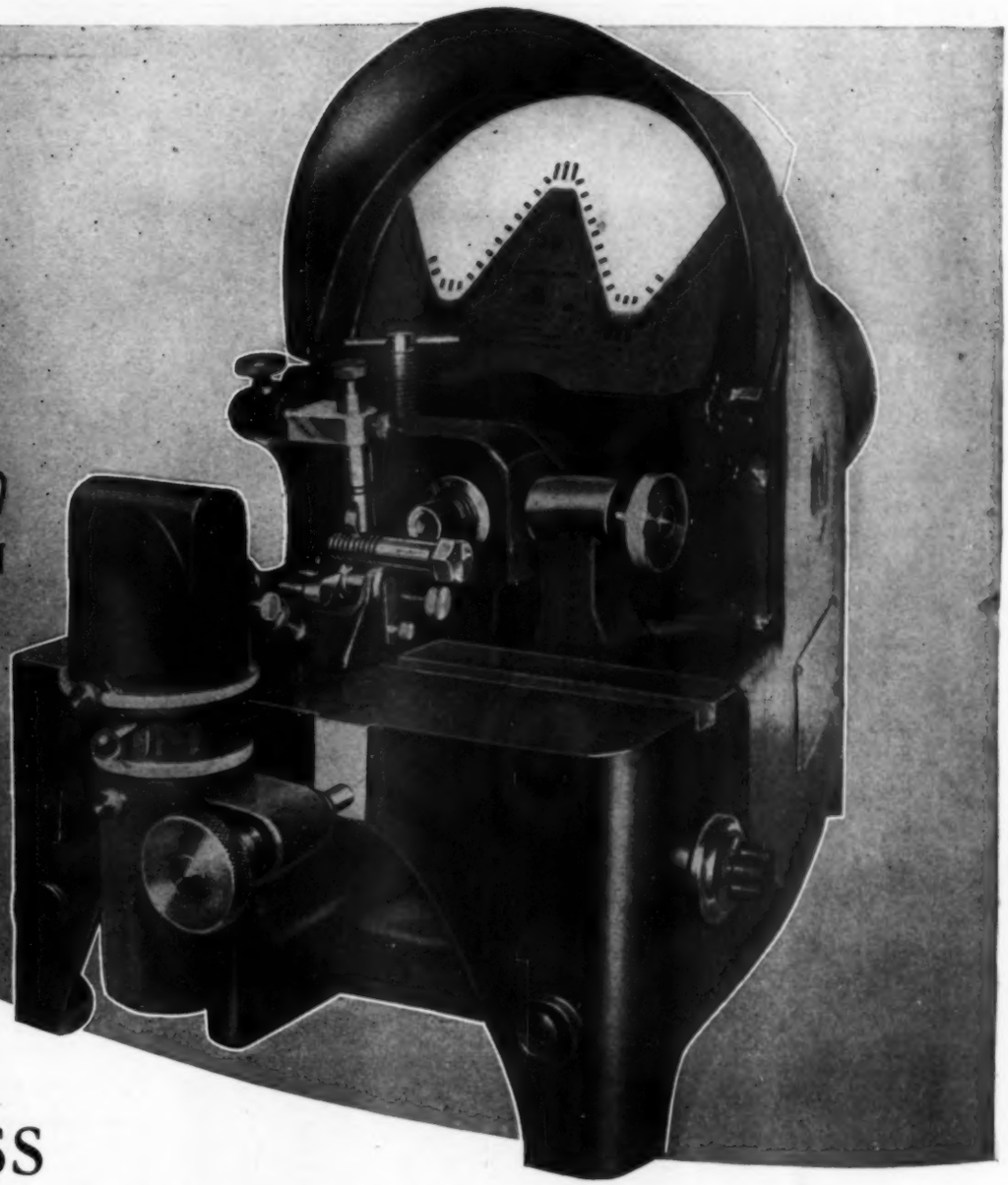


The
HARTNESS
COMPARATOR
shows at a glance—

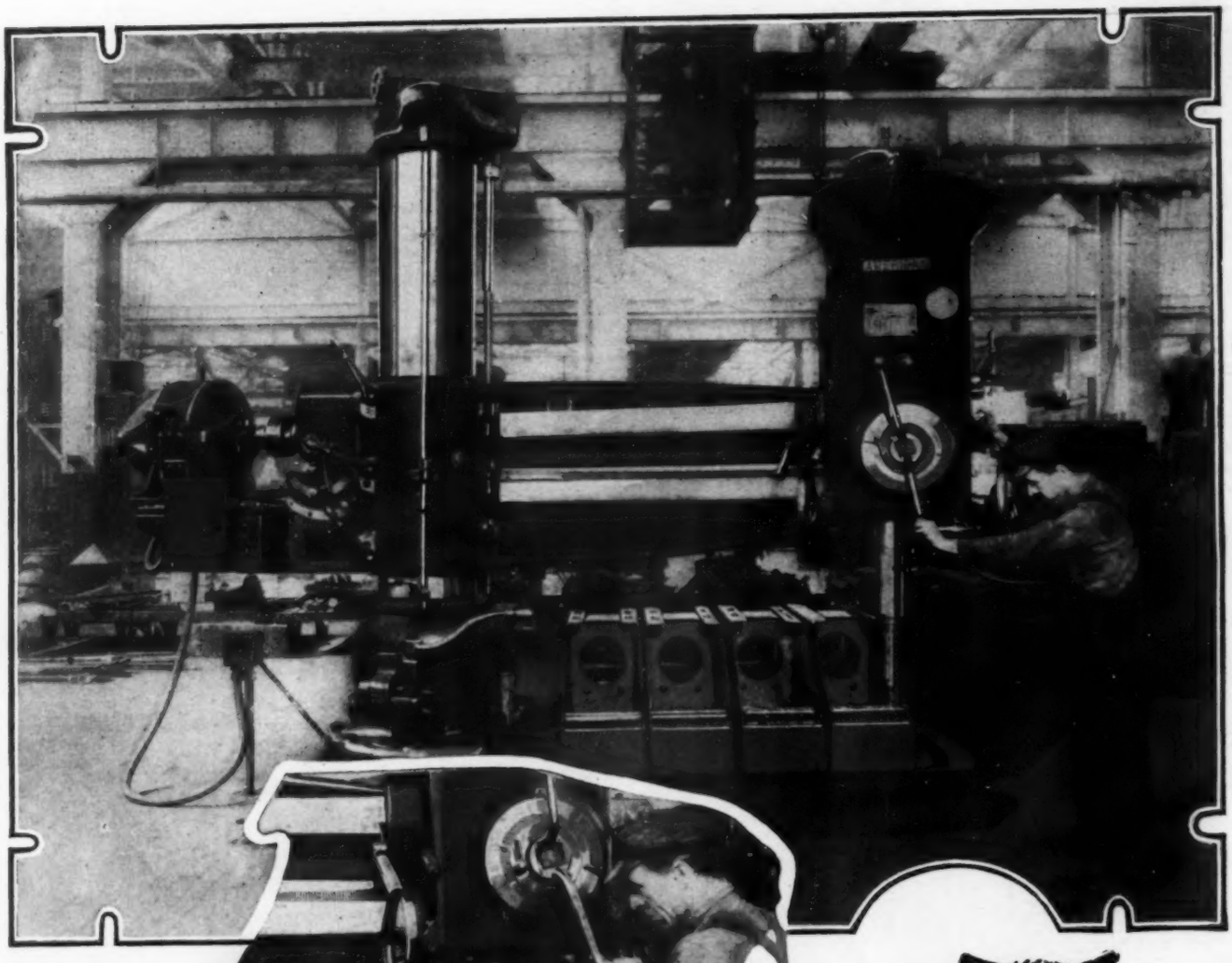
1. A shadow of a perfect screw thread.

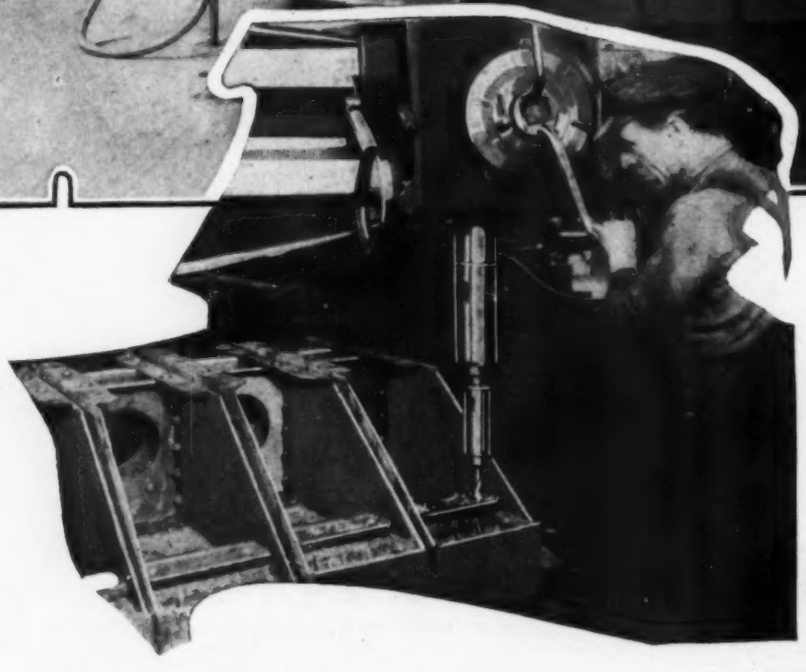
2. Shadow of the smallest screw that will pass Comparator inspection. It is of correct lead, good form and minimum pitch diameter.

3. A screw undersize on pitch diameter with a full root. This would feel a good fit in the average gage.

4. Unacceptable on account of lead error and roughness.

MACHINE COMPANY
VERMONT

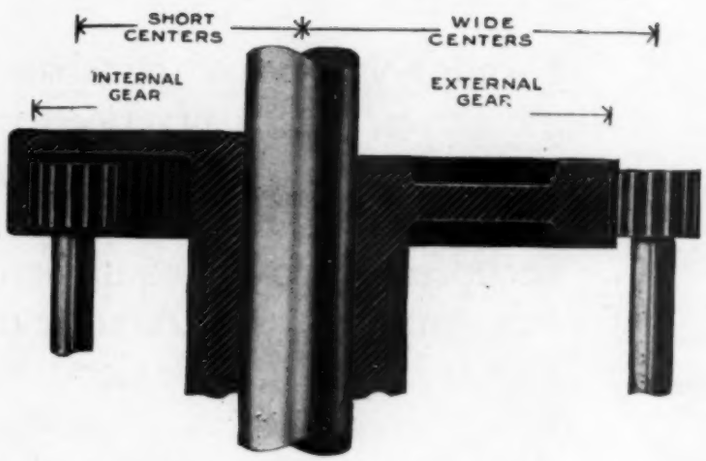




LATHES
RADIALS
SHAPERS

The American Tool Works

"AMERICAN"



internal gear drive

Two commanding advantages that spring from this exclusive "American" feature

A smooth power flow that knows no vibration, a silent gear train that combines long life with silence, are two commanding advantages that spring from the internal gear-driven spindle—an exclusive, patented feature found only in the "American" Triple Purpose Radial.

The explanatory cut above shows the difference between the ordinary design and the "American" way. Note how the internally driven pinion nests inside the large internal gear. As is commonly known, an internal gear and pinion have greater tooth area in contact. That makes for a powerful, smooth rolling contact that never generates any vibration. That in itself is the best guarantee of precision finish. Furthermore, the internal design allows shorter centers and a close, compact design of the whole head.

Using gears as large as used in the "American," but on the ordinary external method of driving, would require a much larger head—or the use of a nest of small diameter high speed gears that quickly wear and grow noisy.

Special Notice!

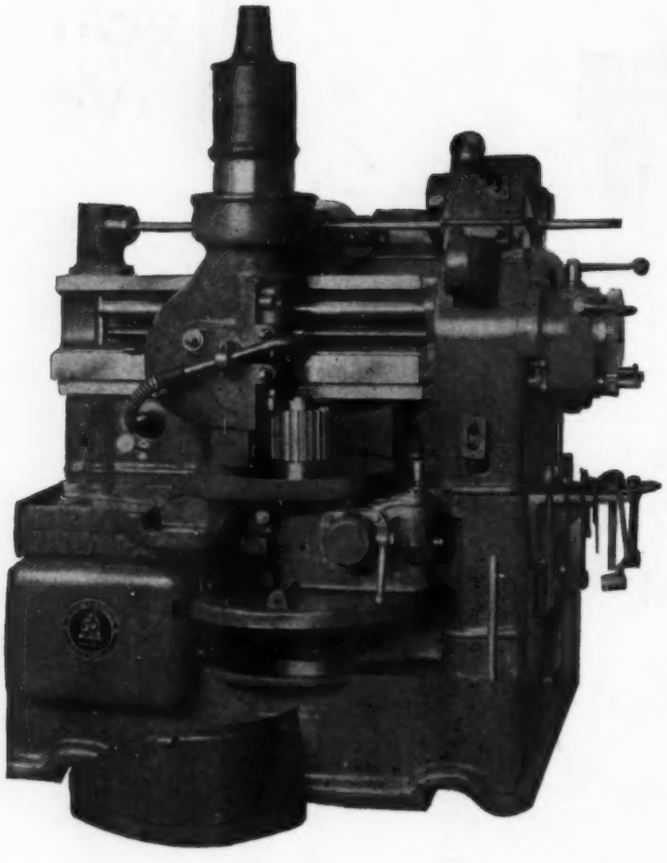
When using machine for average drilling and tapping operations, the large internal gear is automatically disconnected from the spindle and remains stationary—thus eliminating all flywheel action from spindle and freeing the tapping attachment clutches from the wear and deterioration caused by overcoming the inertia and momentum of the driving members.

You ought to know more about the New "American" Triple Purpose Radials.

s Company, Cincinnati, U.S.A.

Shaping Gears To Industry's Needs

In the Plant of A



The design of the Fellows Gear Shaper cutter is based on a fundamental principle and is capable of almost universal application. To correctly apply this principle has, however, required years of experience in its use. These many years of experience are at your service.

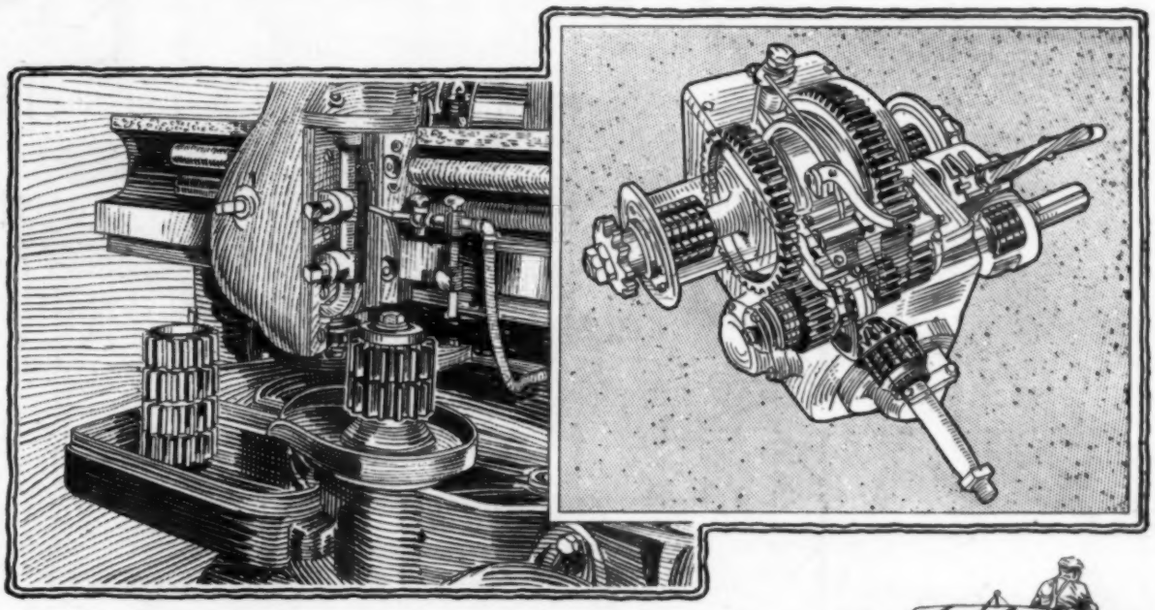
Farming is one of our basic industries, but as practiced in most countries, outside of the United States, it is a laborious occupation. Power equipment has enabled the American farmer to till more land at lower cost and in a shorter period than is true in any other country in the world.

The farm tractor has greatly helped in this connection and as built today is a creditable piece of machinery. Gone are the gears with cast teeth exposed to the dirt and elements.

Cutting Truck and Tractor Transmission Gears

Truck and tractor manufacturers have adopted, in most cases, the same methods as the automobile manufacturer, both as regards manufacturing equipment and also in the use of alloy steels for transmission gears, etc.

A Tractor Manufacturer



The use of high-grade alloy steels has made possible the design of compact and comparatively light transmission units, which are capable of withstanding hard service. It has also made possible the use of finer-pitch gears where extremely coarse-pitch gears were formerly used.

Spur Gears for Tractor

THE FELLOWS GEAR SHAPER COMPANY

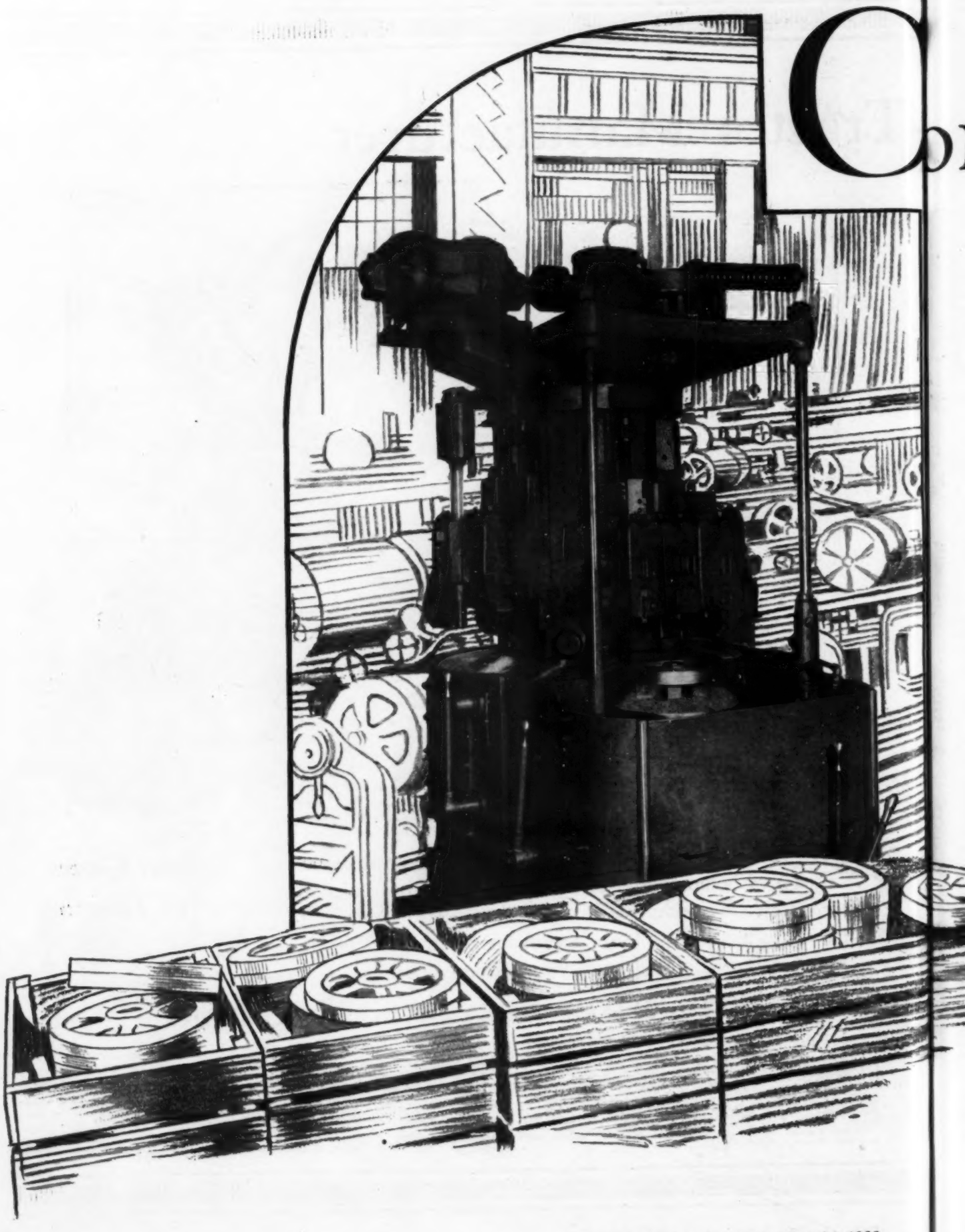
Head Office and Works: **78 River Street, Springfield, Vt., U. S. A.**

Branch Office: 1149 Book Bldg., Detroit, Mich.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, England—Great Britain; Alfred Herbert, Ltd., Calcutta and Bombay—India; Alfred Herbert, Ltd., Osaka—Japan and China; Alfred Herbert (Australasia), Ltd., Sydney—Australia; Alfred Herbert, Ltd., Buenos Aires, Argentina; Societe Anonyme Alfred Herbert, Paris—France; Societa Anonima Italiana Alfred Herbert, Milan—Italy; Societe Anonyme Belge Alfred Herbert, Brussels—Belgium and Holland; Bohm & Bormann, Berlin—Germany, Austria, Czecho-Slovakia, Poland and Hungary; Aktiebolaget A. Bonthrom, Stockholm—Sweden, Finland and Norway; Mathey-Doret & Forrer, Zurich, Switzerland; Hijo de Miguel Mateu, Barcelona—Spain.

SOUTHERN REPRESENTATIVES: Jones Machy. Company, Atlanta—Georgia; Montgomery & Crawford, Spartanburg, S. C.—South Carolina and Western North Carolina; Young & Vann Supply Company, Birmingham—Alabama; Oliver H. Vanhorn Company, New Orleans—Louisiana, Mississippi, Western Florida and Eastern Texas; Huey & Philp Hardware Company, Dallas—Western Texas.

PACIFIC COAST REPRESENTATIVES: C. F. Bulotti Machinery Company, San Francisco for Northern California; Norman Reeves, Los Angeles for Southern California.



OMPLETELY AUTOMATIC

THE BULLARD

AUTO-MATIC
VERTICAL TURRET LATHE

A new tool for a new era of production economy—typically Bullard and productive in every way to Bullard performance standards.

Consider carefully these important features:

Feeds and speeds are independent and automatically changed for each station as set.

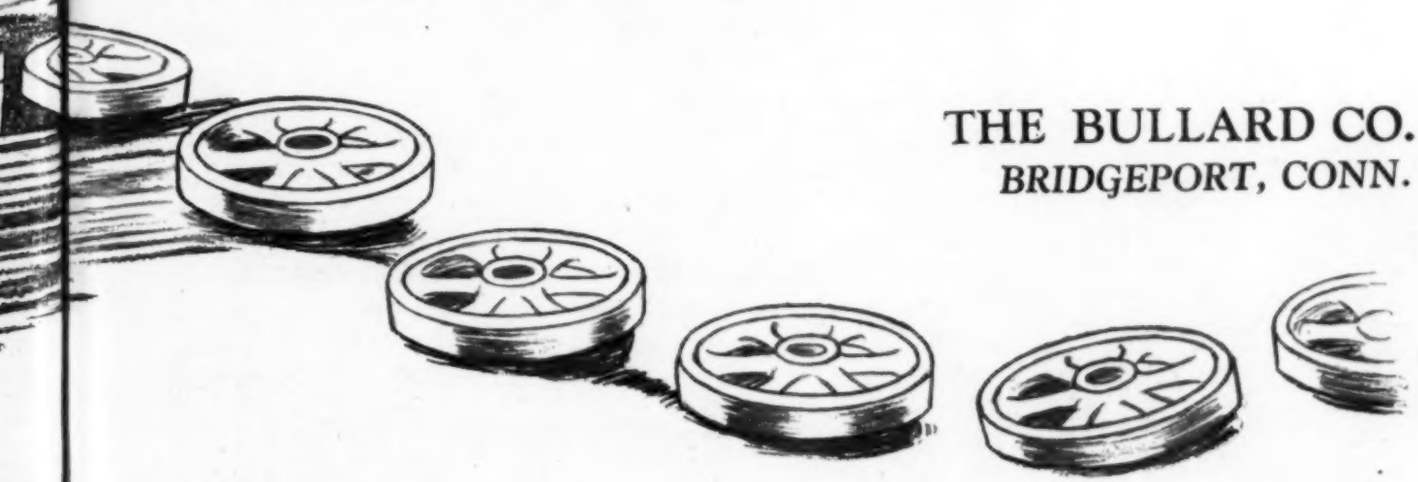
Length of feed is adjustable for each station, so that there is no lost feeding-time.

A live spindle drill head is provided to speed up drilling of small holes, while larger diameters are being turned.

Accessible tooling, which may be quickly changed from one set-up to another.

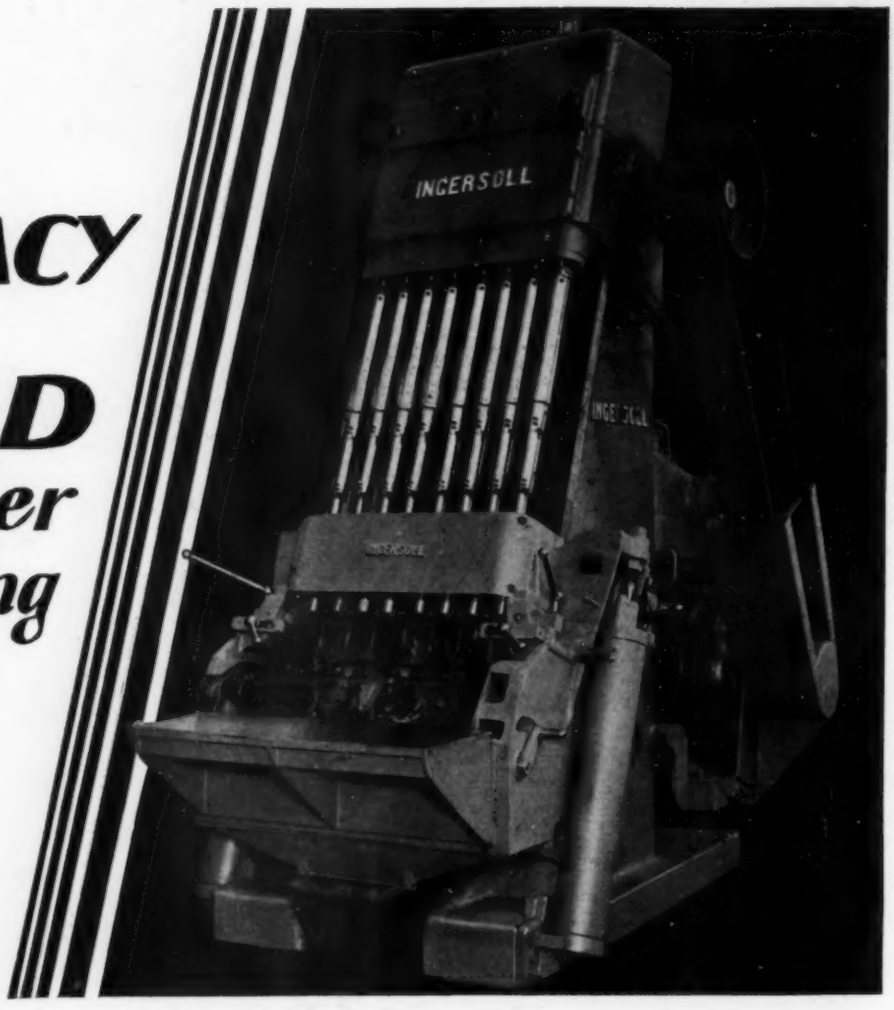
On the production floor, one man can operate a battery. The Auto-Matic is an ideal tool for short runs and a wide variety of work. Individual tool holders—independent speeds and feeds for each head.

May we send descriptive bulletin that explains the "automatic cycle"?



THE BULLARD CO.
BRIDGEPORT, CONN.

ACCURACY and SPEED in Cylinder Block Boring



Bulletins—

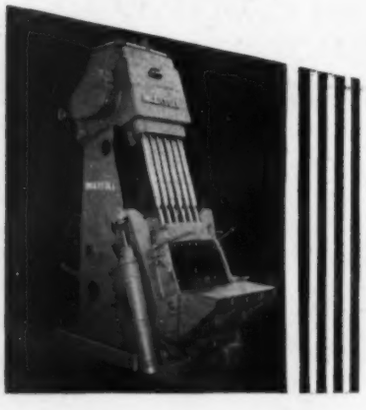
No. 46—"Ingersoll Equipment for Railroad Shops."
No. 47—"Ingersoll Milling Machines."
No. 48—"The Ingersoll Cutter Grinder."
No. 49—"Ingersoll Milling Cutters."

DEPENDABLE, accurate, high production in boring cylinder blocks of all types is easily maintained on these Ingersoll machines. The rugged construction, high feeds, and the simplicity of operation combine to give very low floor to floor times.

Each machine is special for its own job. The machine above rough bores the cylinders and combustion chambers of a straight eight block—a very heavy cut—and turns out twenty-two blocks an hour. The machine at the left rough bores twenty-eight six-cylinder blocks every hour.

Cylinder boring is only one of many milling, boring, and drilling jobs on which special Ingersolls are giving increased production at minimum cost. Our bulletins describe many different types of machines. Write for copies.

Fours, Sixes or Eights



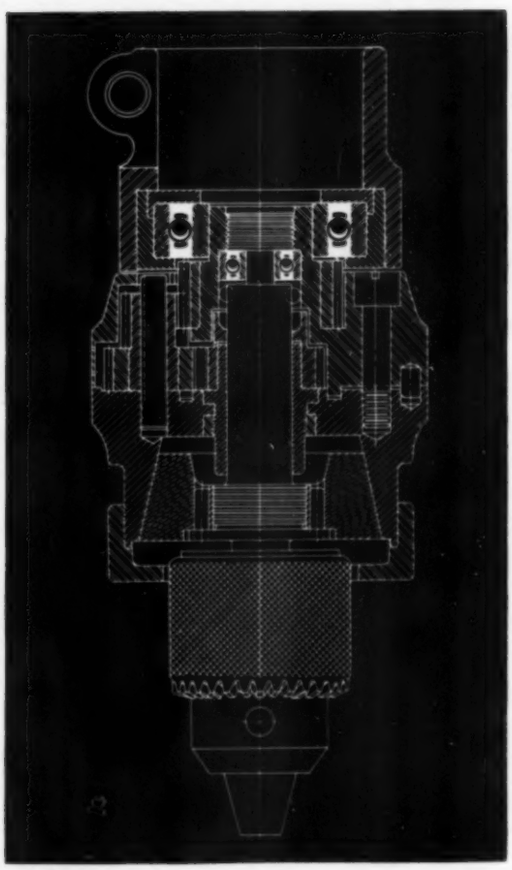
***The* Ingersoll Milling Machine Company**
Rockford..*Milling Machines and Special Machine Tools*..**Illinois**

Ingersoll

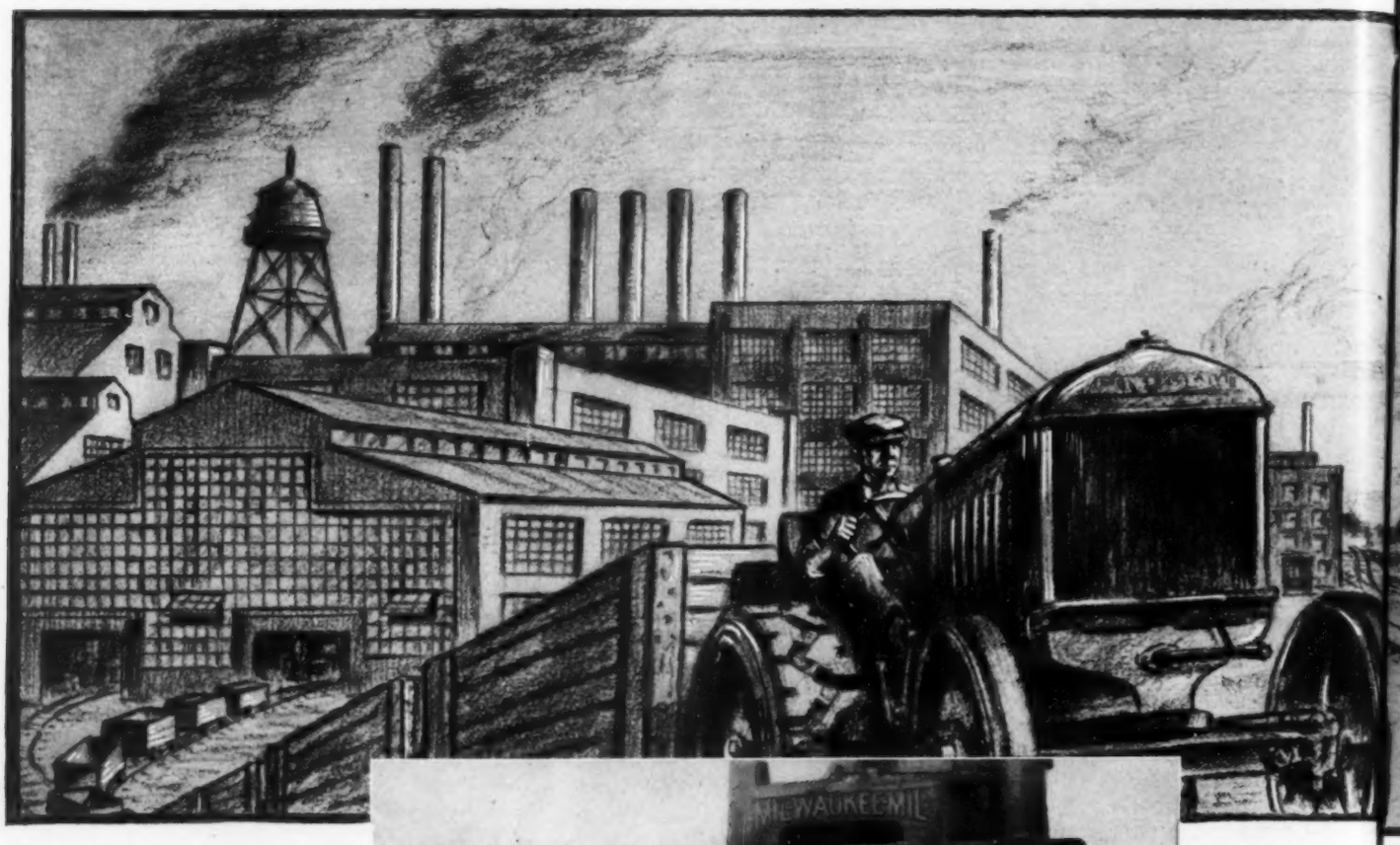
NEW DEPARTURE BALL BEARINGS

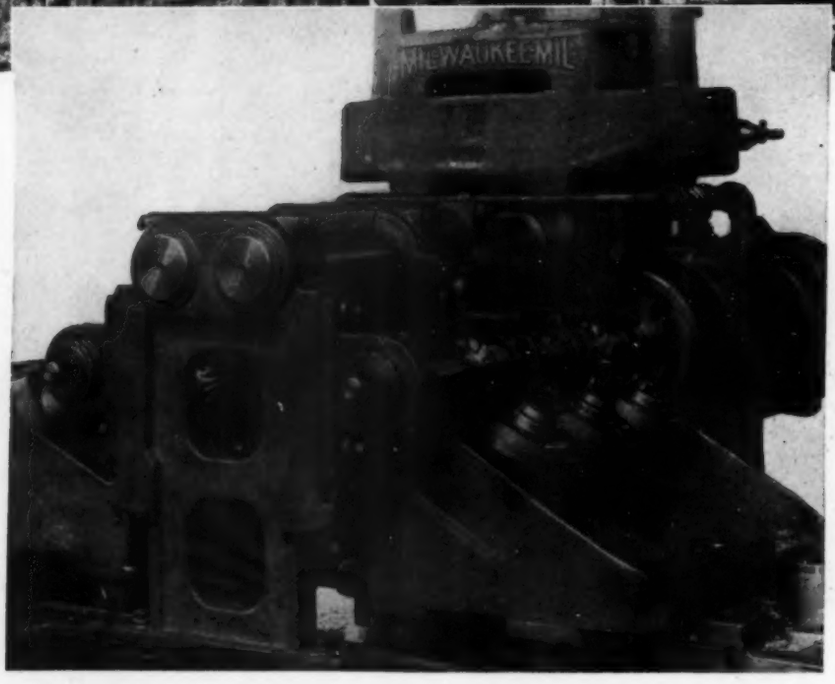
New Departure electric steel is strong, tough and enduring—each bearing is a simple, dependable unit whose rolling elements are not susceptible to misalignment, friction or wear — for nothing rolls like a ball.

The New Departure Mfg. Co., Bristol, Conn.; Detroit, Chicago, San Francisco.



FASTER tapping and less tap breakage are claims which the Charles L. Jarvis Company makes for its high-speed tapping device . . . claims which two New Departure Ball Bearings help to make long-lasting realities — by eliminating friction, looseness and chatter — by maintaining the accurate positioning of the working parts.

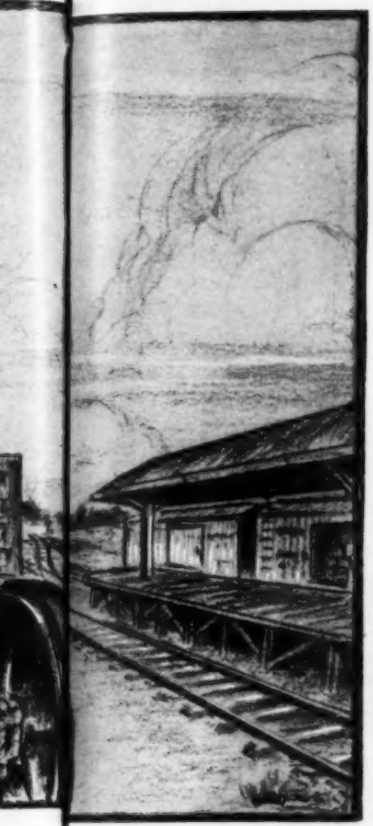




This No. 1404 Mil-waukee-Mil Simplex with two-spindle horizontal head and two independently controlled tables, is "keeping production moving" on tractor differential gears. With two fixtures—one to hold three 28 tooth gears and the other for four 14 tooth gears—this machine turns out 58 to 60 gears an hour.

Wherever there is milling to be done you will find the mark of one who understands the milling problems of all industries—the K&T Production Service Engineer.

IF IT CAN BE MILLED



KEEPING THINGS MOVING

Speed and efficiency—the very things for which tractor builders are striving in order to reduce manufacturing costs, has created another important use for their own product—that of industrial plant haulage. Hauling materials from yard or storeroom—parts from one department to another—finished product from warehouse to shipping point—tons of metal—miles of travel—the industrial tractor is busy all day long "keeping things moving".

How well tractor manufacturers realize the need for speed and efficiency in their own plants. In the plants of the leaders you will find the most efficient production methods and modern machine tools. There too, you will find many, many Milwaukee Milling Machines unfailingly carrying their burden of responsibility in keeping production moving.

There is something more behind the name "Milwaukee" than just a milling machine. The milling methods developed by K&T Production Service Engineers and their economical application to the milling problems of all industries, give this name an unique significance in the milling field. "Milwaukee" preference in the tractor industry is the result of "Milwaukee" efficiency in the hands of the user.

No matter what your milling problem may be—extreme accuracy or high production—or both—when you use Milwaukee Millers you acquire the utmost in quality, efficiency, and profitable milling operation.

KEARNEY & TRECKER MILWAUKEE MILLING MACHINES

Solving Industry's Problems with Milwaukee Milling Machines

Airplane Engine Series

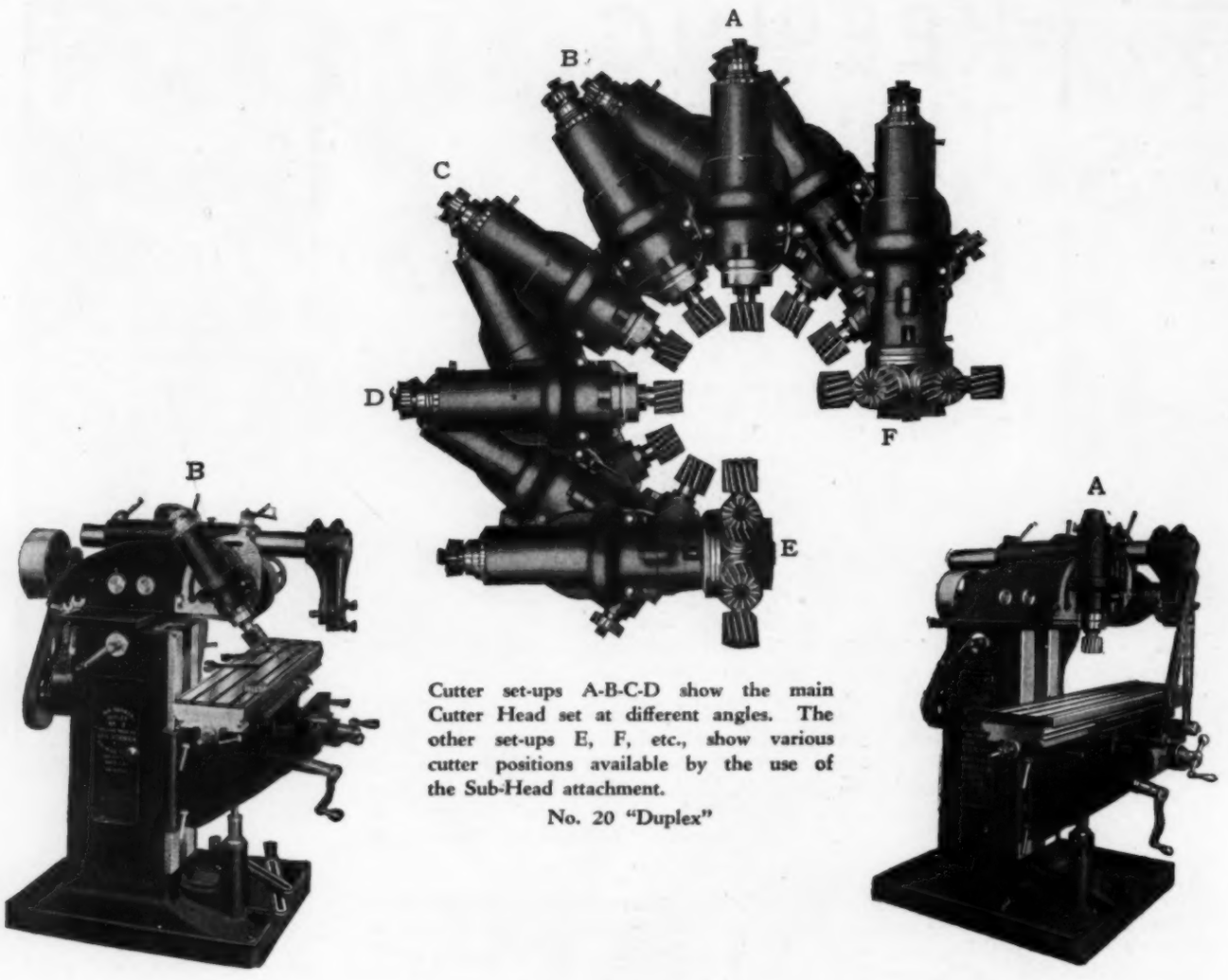
Tractor Series

1—Clutch Shaft Pinion.
2—Pads on Manifold.
3—Four Faces of Connecting Rods.
4—Teeth in Bevel Gears.
5—Crankshaft Cover.
6—Bolt, Bosses and Bearing Caps on Connecting Rods.
7—Differential Gear Teeth.

Tractor power has placed material handling on a production basis throughout industry. In machine shops, foundries, railroad yards, steel mills, brick and tile works—wherever bigger loads mean lower costs—you will find the tractor "keeping things moving."

Pictured here is a well-known tractor hustling through its morning work in a large railroad yard in Chicago.

D ---MILL IT FASTER!



Cutter set-ups A-B-C-D show the main Cutter Head set at different angles. The other set-ups E, F, etc., show various cutter positions available by the use of the Sub-Head attachment.

No. 20 "Duplex"

No Other Machine Is So Adaptable for Widely Different Cutting Set-ups

The Van Norman "Duplex" with its Swivel Head and Slidable Ram is the Most Completely Universal Milling Machine.

Its Flexibility and Range—with Quick Set-ups—means Actual Time and Money Saved.

Write for Specifications

Van Norman
machine tool co.
SPRINGFIELD ~ ~ ~ ~ ~ MASS.

The NEW MODERN Stationary Die Head Offers these Advantages ~~~

THE New Modern Style T Self-Opening Stationary Die Head is the result of more than thirty-five years of specialization in the design and manufacture of small tools for the shop. It embodies every requirement for continuous, accurate and efficient service.

Capacity — Cuts straight or taper, right or left hand from the coarsest to finest standard thread. Capacity, Style T up to 2", Style B from 2" to 7".

Simplicity — Simple construction keeps the Modern Die Head on the job. No complicated parts to wear out or repair.

Positive Opening—The die head is cammed to work with the revolving of the cam ring. Retarding or stopping the turret opens the die head.

Rigidity—Chasers are as firmly supported as in a solid tool. They cannot "rock" or change position.

Construction — The finest material and workmanship are combined to assure accurate performance and lasting service from Modern.

Other Modern Tools

Self Opening Die Heads (Stationary Type)
Self Opening Die Head (Rotary Type)
Solid Adjustable Die Heads
Adjustable Hollow Milling Tools
Collapsible Taps
Magic Quick Change Drill Chucks (Positive and Friction Drive)
Friction Tap Collets
Self Opening Stud Setters
Tapping Attachments
Threading Machines
Chaser Grinding Machine
Insert Tool Face Milling Cutters

MODERN TOOL WORKS

Division of

CONSOLIDATED MACHINE TOOL CORPORATION OF AMERICA

ROCHESTER, NEW YORK

Modern Tool Works, Rochester, N. Y.

Kindly send your bulletin describing the new Modern Style T Stationary Die Head.

Name.....

Address.....

City..... State.....

"A Rigid Spindle Free from Chatter"

—*Says Porter-Cable*

The spindle precision of "Carbo-Lathe", latest product of the Porter-Cable Machine Company, Syracuse, N. Y., is established and protected by Timken Bearings.

The reasons which governed the choice of Timkens are summed up by A. N. Emmons, Chief Engineer of the Porter-Cable Machine Company as follows:

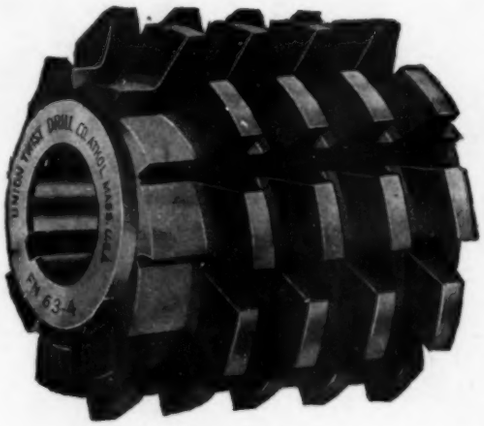
"We selected Timken Tapered Roller Bearings for the main spindle of our new CARBO-LATHE so that we might obtain a short, rigid spindle that would be free from chatter and easily assembled and adjusted. Results of our tests have proven that we made no mistake in our selection."

In all types of machine tools, "Timken Bearing Equipped" means spindles that run true permanently —with nose accuracy maintained as years go by. Spindles that utilize the fullest possibilities of the new higher-speed cutting tools. Spindles with unequaled rigidity. Spindles that are chatterless. Spindles that do more accurate work faster at lower cost.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

Mechanically Right



Every UNION HOB is carefully tested for accuracy of lead and form.

UNION HOBS for spur and spiral gears are carried in stock for all makes of hobbing machines.

Let us tell you all about UNION METHODS of making Metal Cutting Tools, especially UNION Ground and Unground HOBS. Just write for complete booklet —*"Hobs and Their Uses."*

UNION
Twist Drill Co.
Athol, Mass., U. S. A.

121 Second St., San Francisco
Chicago, 11 So. Clinton St. — New York, 62 Reade St.
Mansfield, Mass. — Derby Line, Vt.
Rock Island, Quebec

Representatives Throughout the World

"Quality Tools You Buy Again"

BRUBAKER

GOOD TOOLS

A new year is again with us. Time does fly! Same old problems to wrestle with—and a lot of new ones due! It is certain that 1930 will be an active year; that many interesting developments will occur; that changes more or less radical will take place. This is not a guess. It has been so, year after year—and there's no reason why the next twelve months should be any exception.

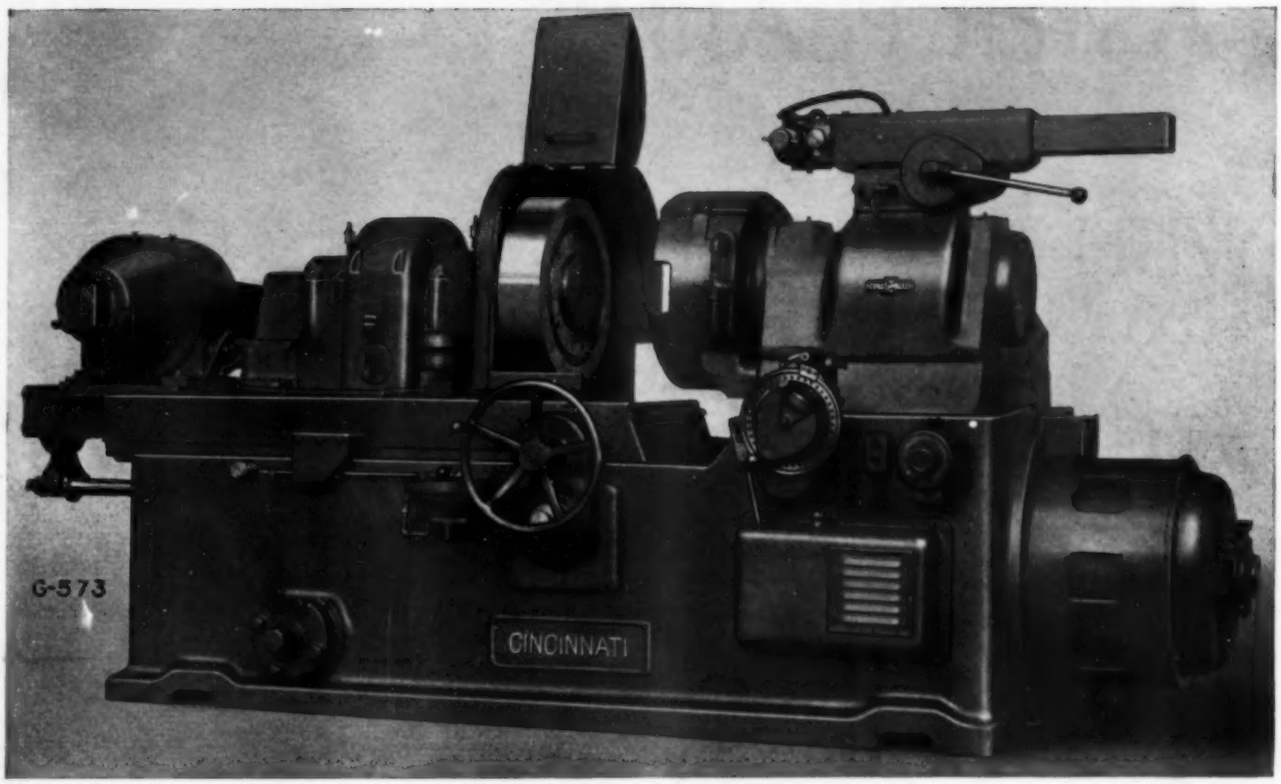
You can be certain of this, too; that Brubaker Tools will continue to give you the maximum of efficiency and economy in the operations of threading, reaming, milling and counterboring. When better tools are made Brubaker will make them.

We recommend, as one of the things you do to start the new year right, that you consult with us on the selection *and use* of the proper Brubaker Tools for your work. This advisory service is offered freely and our engineering staff is both prompt and thorough. Write us.

W. L. Brubaker & Bros. Co.

Factory at Millersburg, Penna.

Sales Office: 50 Church St., New York



Patented

Improved Cincinnati Brake Drum Grinder

Here are the improved features which are now incorporated in the latest model Cincinnati Brake Drum Grinder:

1. Fully guarded grinding wheel.
2. Anti-friction grinding wheel spindle bearings with chain drive.
3. Independent in-feed attachment driven by individual motor — wheel can be fed into work by hand or power.
4. Improved wheel dresser operated by a hand lever. Ross dresser used. Independent coolant supplied to dresser.
5. Self-contained coolant pump mounted on outside of machine with pump below coolant level.

BESIDES the new features listed at the left which add to the safety of operation and reliability of production, the improved Cincinnati Brake Drum Grinder embodies other advantages. A cam driven from the headstock spindle provides reciprocation of the mounted drum over a short stroke to impart an exceptionally smooth braking surface. To facilitate loading and unloading of drums, the travel of the workhead is air-controlled from a small valve conveniently located at the operator's left hand. By operating on the plunge cut principle, tremendous metal removal capacity is obtained, thus giving high production. A sizing device can be applied which insures accurate grinding of all drums. This grinder has a capacity to swing work up to 26" external diameter thereby permitting the mounting of wheel and drum assemblies with machine as well as unmounted drums. Inside diameters up to 22" can be ground on mounted drums. A rotary type magnetic chuck is supplied for firmly holding the work.

The Right Machine for the Job

CINCINNATI GRINDERS INCORPORATED, CINCINNATI, OHIO, U. S. A.

CINCINNATI

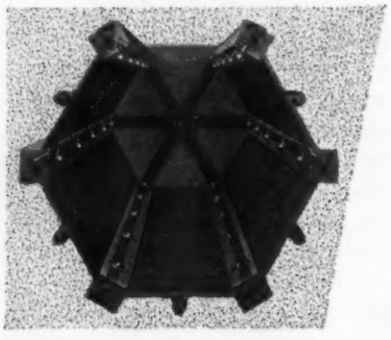
FASTER PLATING

WITH

ALL BAKELITE

CYLINDER

HANSON-MUNNING BARRELS



X-ray view illustrating how built-in metal star distributes the current to all six metal ribs and contacts.

That is what the platers say. And these cylinders, with ordinary care, last for years in acid solutions and are giving exceptional service in strong alkali solutions.

Hanson-Munning Plating Barrels are furnished in many sizes and forms —motor operated or belt driven.

Whenever you need better service in plating, Hanson-Munning Engineers are at your command with practical information and a complete line of polishing and plating equipment and supplies.

HANSON-MUNNING PRODUCTS

Polishing Machines, Lathes, Plating Equipment, Generators, Barrels, Tanks, Wheels, Abrasives, Buffs, Brushes, Compositions, Cleaners, Anodes and Salts

HANSON MUNNING

Leading manufacturers of polishing and plating equipment and supplies

Hanson-Van Winkle-Munning Co., Matawan, N. J., and Chicago

3069

The Symbol of a Vast Industrial Merchandising Power

We are exhibitor-members in the MacDonald Bros. Engineering Laboratories, Inc., the largest engineering institution in the world.

See our exhibit at
1500 Oakman Boulevard
Detroit, Michigan, U. S. A.

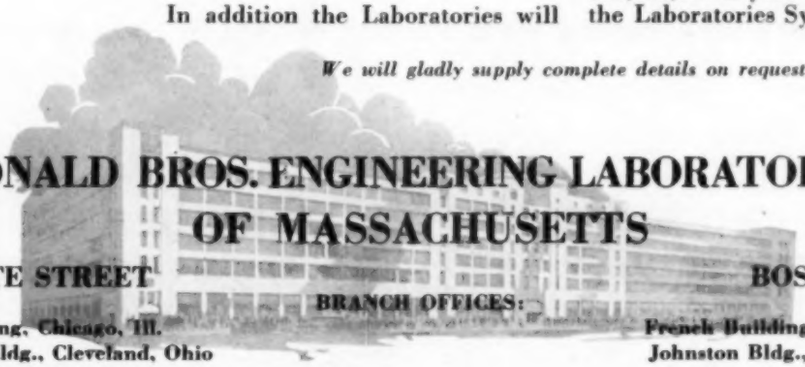
THE above symbol, and the message therein, used in the advertising of a manufacturer means that that manufacturer is an exhibitor-member of MacDonald Bros. Engineering Laboratories, Inc.—the greatest power ever created for the purpose of merchandising manufactured goods to Industry.

Back of the symbol will stand approximately one thousand exhibitor-members. Each member is franchised to use the symbol in all of his advertising. Each member spends an average of $20,000 a year in advertising his products—a combined advertising budget of $20,000,000 per year to create world-wide prestige for the exhibitor-members and their respective products.

In addition the Laboratories will conduct an independent advertising program for the benefit of the exhibitor-members by the expenditure of a sum not less than 5% of the gross income from all sources. This, in itself, will make an advertising program of considerable selling power.

To manufacturers in the metal-working industry and to those building equipment for the industry, the MacDonald Bros. Laboratories will be a new merchandising power, entirely without precedent. It will combine permanent exhibition space in the new Laboratories building in Detroit, Michigan, facilities for tests under shop conditions, a product engineering service by a permanent staff of competent engineers, and a combined advertising force of over $20,000,000 a year through use of the Laboratories Symbol.

We will gladly supply complete details on request.



MacDONALD BROS. ENGINEERING LABORATORIES, Inc.
OF MASSACHUSETTS

131 STATE STREET **BOSTON, MASS.**

BRANCH OFFICES:

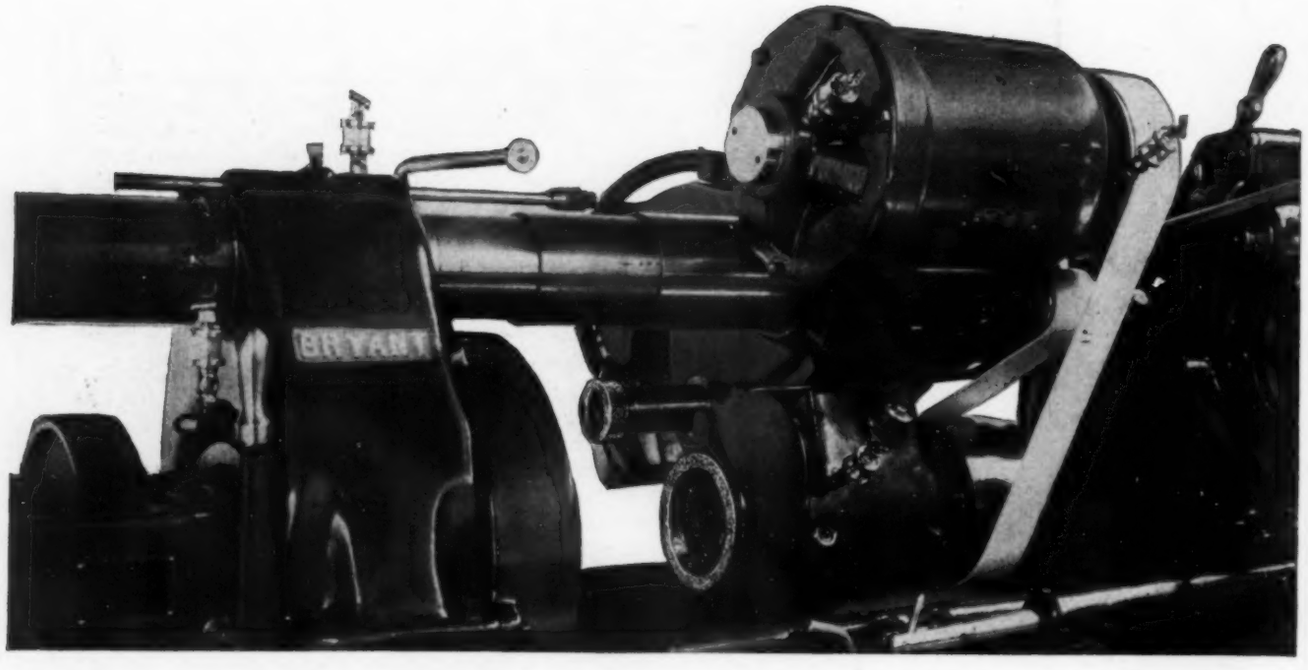
Straus Building, Chicago, Ill.
B. F. Keith Bldg., Cleveland, Ohio
French Building, New York City
Johnston Bldg., Charlotte, N. C.

Two Operations—One Handling

Possibilities on the

BRYANT 12-A Grinder

1. Hole and face.
2. Outside dia. and face.
3. Outside dia. and hole.
4. Multiple faces.
5. Undercut face and hole.
6. Multiple internal dias. and face, etc.



No. 12-A BRYANT Grinder with Facing Wheel in Grinding Position

BRYANT CHUCKING GRINDER COMPANY
300 CLINTON STREET SPRINGFIELD, VERMONT

U. S. A.

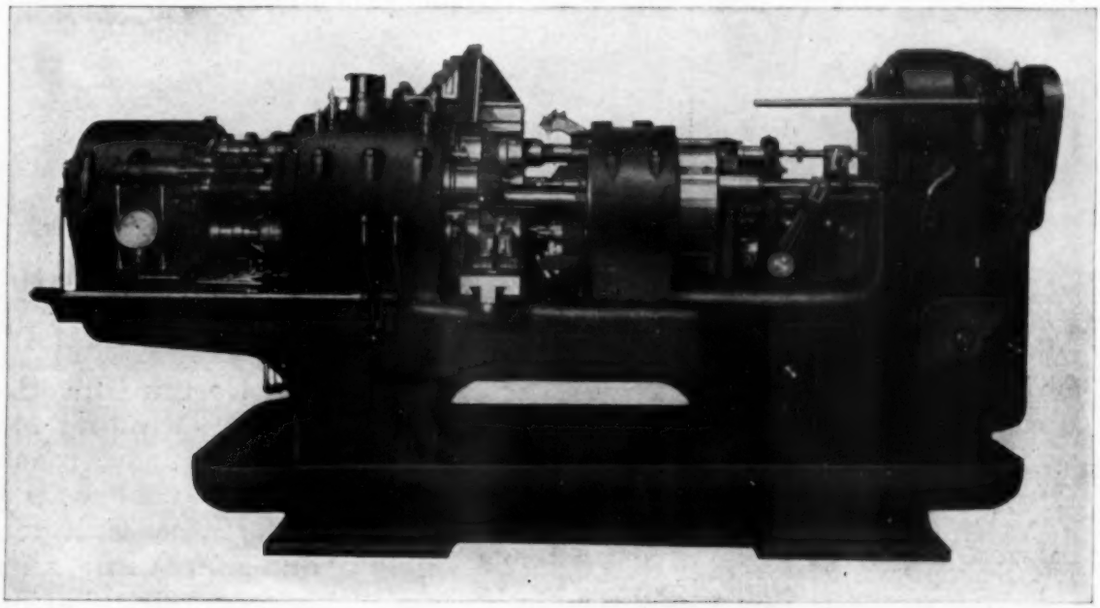
New Size, New Capacity, New
HYDRAULIC CONTROL

...In this 7-inch, 5-Spindle, Cleveland Automatic Chucker

WITH 7-inch capacity, 5-spindle performance, this new Cleveland Automatic Chucking Machine offers an oil operated hydraulic chucking action which attracted wide attention at the recent machine tool show.

Aside from the source of power used to drive it, this machine is entirely self dependent. The expense of a compressor and connections is avoided and it is not subject to the fluxations of power, experienced where air lines have excess demands for other purposes.

Its hydraulic chucking unit includes high and low pressure oil pumps, a pressure changing mechanism and built-in control valve, mounted on the oil supply reservoir. Hydraulic chucking offers a positive chucking force, equal to any demand, yet conformable to the variations in the castings and forgings and with pressure adjustable to the nature of the work.



Highly accessible in all its parts, the machine is tooled and operated by an operator standing at all times in front of the machine. Its 7-inch capacity and its five spindle operation offers a new standard for multiplicity of cuts on large work.

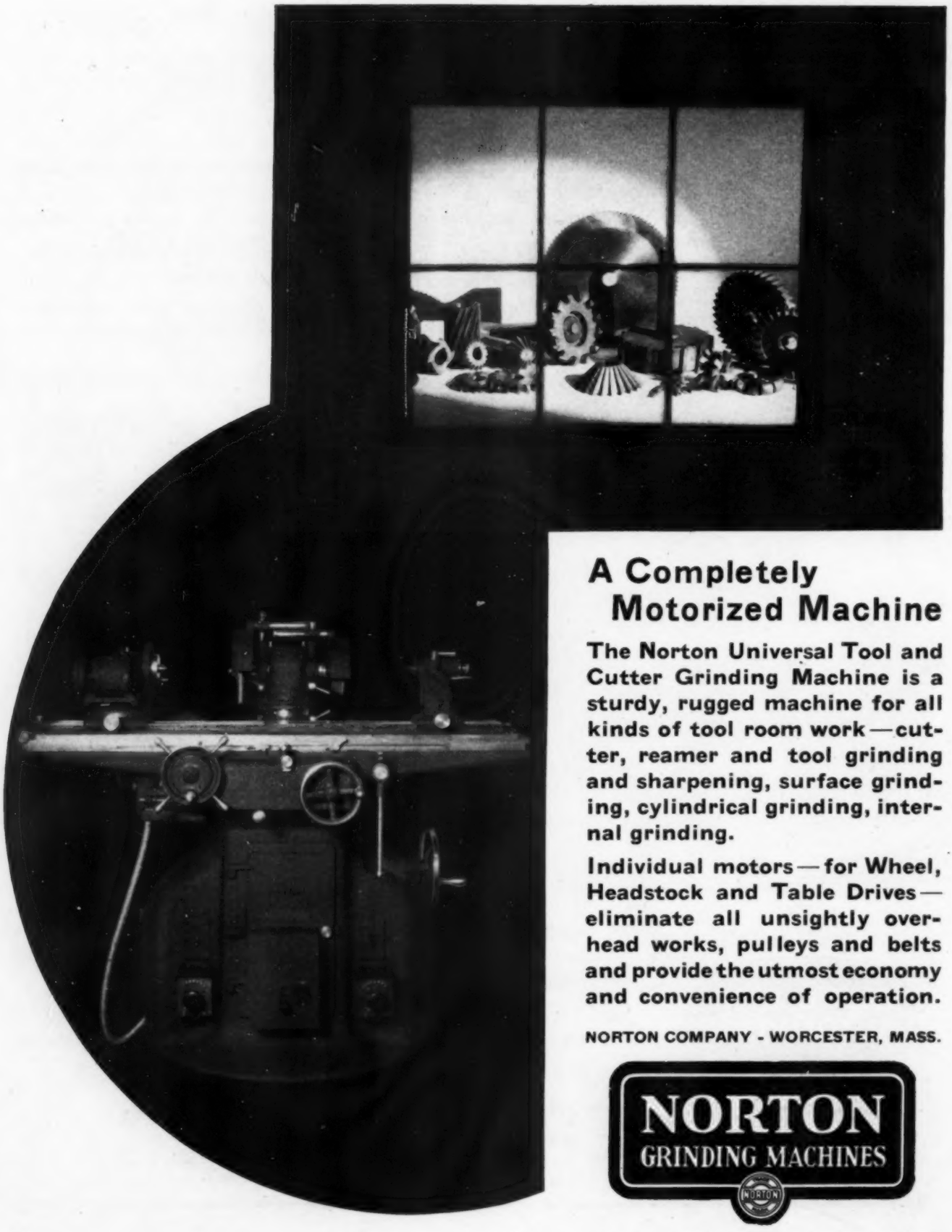
Send for a bulletin describing this machine in detail and rely on Cleveland Automatic engineers to suggest the special tooling application that fits your problem.

CLEVELAND AUTOMATICS

THE CLEVELAND AUTOMATIC MACHINE COMPANY
2269 E. 65th St., Cleveland, Ohio, U. S. A.

NEW YORK	CHICAGO	DETROIT
95 Liberty Street	*565 W. Washington Boulevard*	*1217 Book Building*

For Sharpening Tools and Cutters



A Completely Motorized Machine

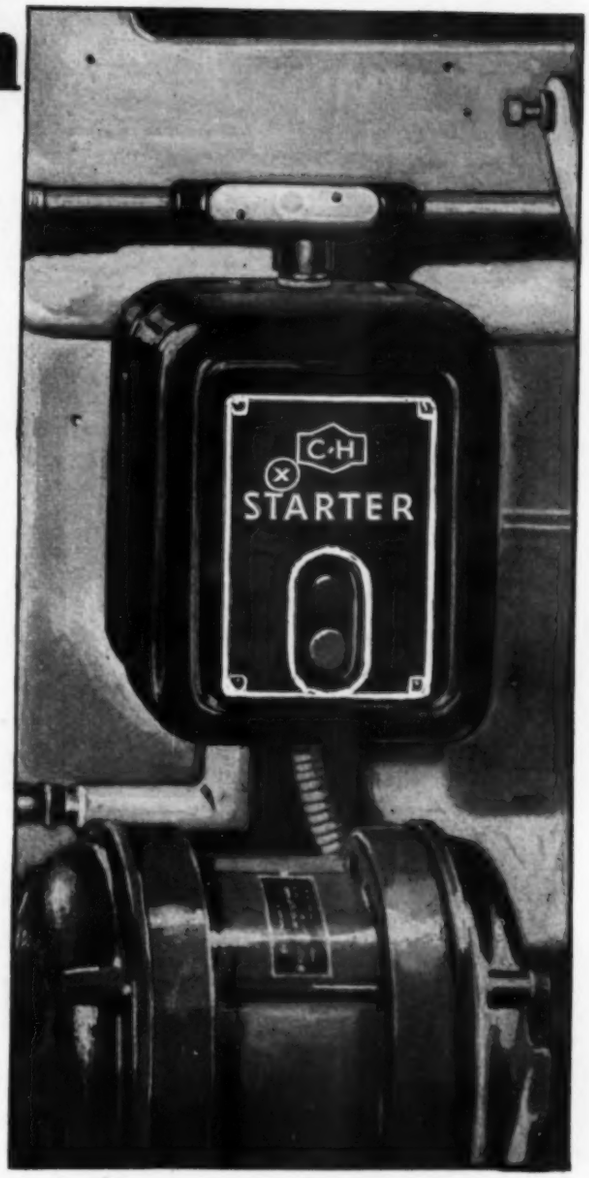
The Norton Universal Tool and Cutter Grinding Machine is a sturdy, rugged machine for all kinds of tool room work—cutter, reamer and tool grinding and sharpening, surface grinding, cylindrical grinding, internal grinding.

Individual motors—for Wheel, Headstock and Table Drives—eliminate all unsightly overhead works, pulleys and belts and provide the utmost economy and convenience of operation.

NORTON COMPANY - WORCESTER, MASS.

NORTON
GRINDING MACHINES

An unfailing index in times *of* rush



WHY are so many orders rush? Because the need for a machine usually predates its purchase! Must selection, then, be hurried . . . must chances be taken that the machine is suited to the job? Not when executives know this index of correct design which guarantees that the builder of the machine thoroughly understands the conditions the machine must meet . . . that he has built for performance rather than price.

On any electric motor-driven machine, Cutler-Hammer Motor Control is this index . . . an unfailing guide to satisfaction. The modern protective features of *this* Control, the degree of convenience in operation it provides . . . such points picture how carefully the machine is engineered.

You will find Cutler-Hammer Motor Control on many leading machines . . . selected because Cutler-Hammer protects motors accurately, which means full utilization of electric power to higher safe limits . . . selected because of the reserve performance built into Cutler-Hammer Control . . . selected because the builder knows his interests are yours, and has installed Cutler-Hammer . . . regardless of cost . . . to safeguard the earnings you expect from the machine.

CUTLER-HAMMER, INC.
Pioneer Manufacturers of Electric Control Apparatus
1282 St. Paul Avenue
MILWAUKEE, WISCONSIN

13 **Thirteen Times the Manpower of Industry Hidden Away in Electric Motors**

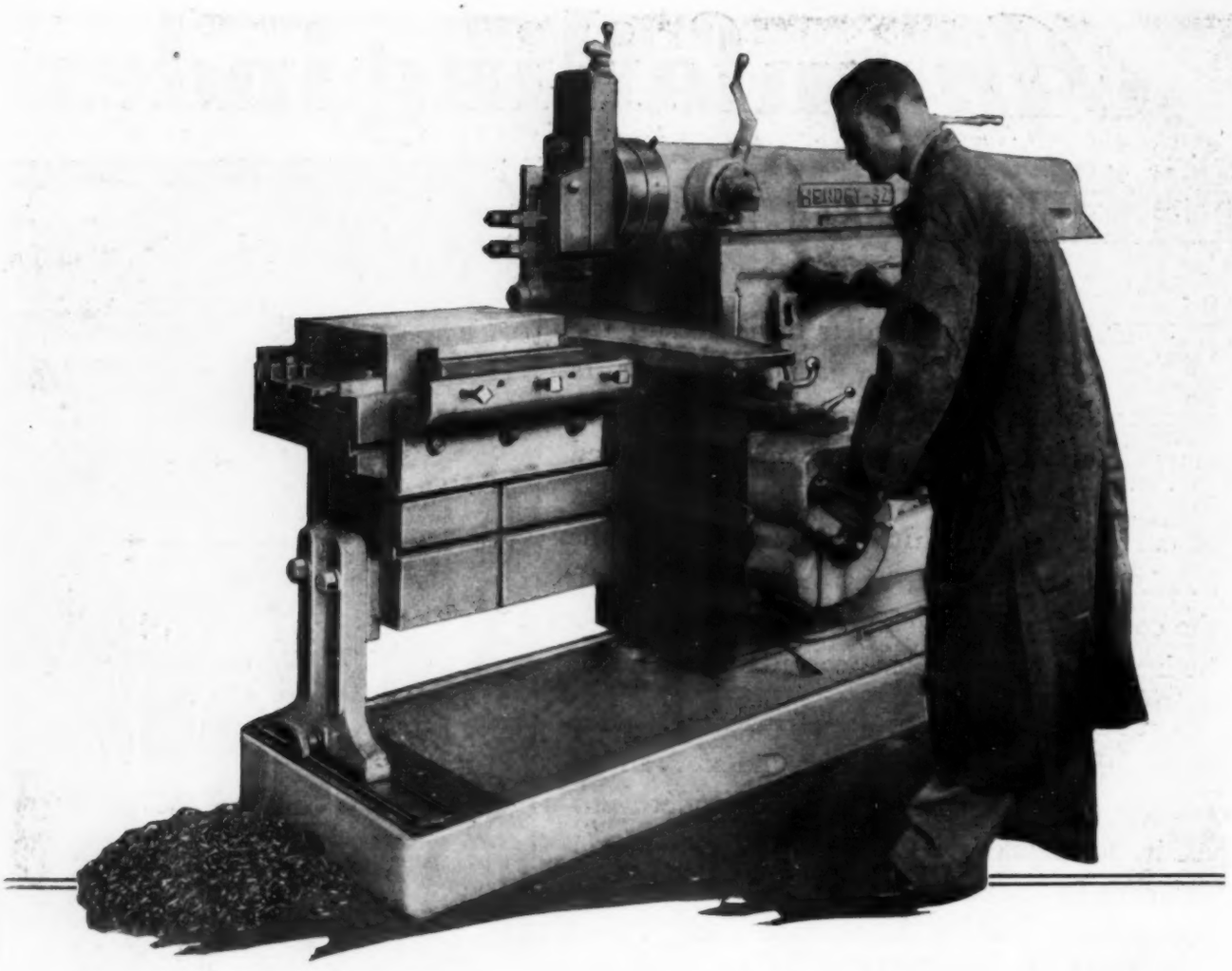
Electric motors in America's industries today provide working capacity equal to 250 million workmen. That is more than 13 times the actual number of men employed. How effectively this army of "unseen" workers is used to bring down costs is determined by the care with which Motor Control is selected.

CUTLER HAMMER

C·H

The Control Equipment Good Electric Motors Deserve

(8623)



Another Die Casting Shop tells why they like the new 32" Hendey Shaper—

Judged from the percentage of work performed on them, Shapers are about the most important tool in a Die Casting Shop.

For that reason they are chosen with utmost care; the difference between just an ordinary Shaper and one of advanced design is sufficient to show up on the cost sheets.

This mid-western Die Casting Shop purchased a New 32-in. Hendey three months ago. When asked how they like it, the foreman wrote in:

"This machine performs very satisfactorily. It has plenty of power and cuts smoothly. Find the rapid traverse a very handy feature and a considerable time saver."

The operator is squaring up a chrome manganese tungsten steel Die block 20 in. long by 18 in. wide —tough work you will agree. Yet this powerful machine never falters in the swift completion of a job.

The new Hendey Shaper is the product of five decades of fine machine tool building. It incorporates many advanced features of design that make it the logical choice where good work to close limits must be turned out in volume.

Write for illustrated leaflet explaining details.

LATHES **HENDEY** SHAPERS

MACHINE CO., TORRINGTON, CONN.

"THE STANDARD OF QUALITY SINCE 1870"

"Those Aurora Drills Are Certainly OK...."

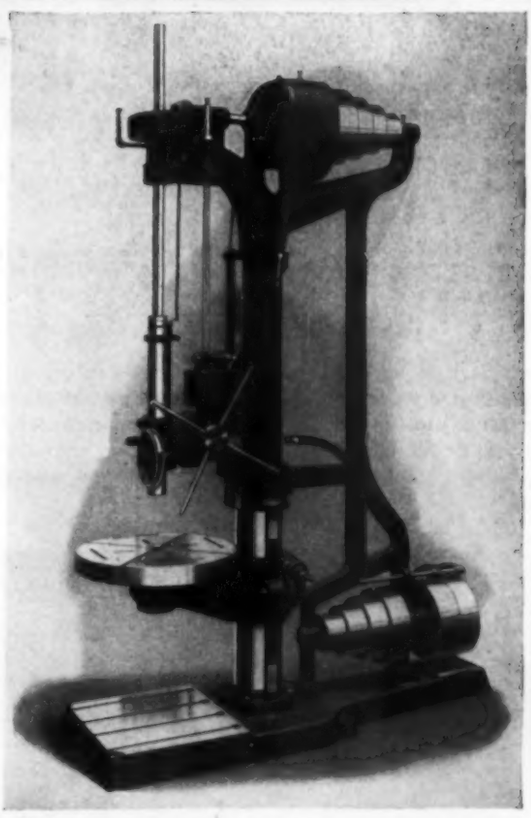
YES, Aurora Drills are OK'd by many production executives. Repeat orders for these improved drills indicate that they are giving satisfaction. They are being used in production lines, tool rooms, repair departments and for assembly work.

Aurora Drills are OK because they meet all requirements. Note these improved construction features:

(1) Hardened and ground washer under crown gear—formerly no thrust washer used.
(2) Shafts ground entire length—formerly not ground.
(3) 31 cent grade tin-base babbitt used—formerly 10 cent grade lead-base babbitt.
(4) Pack-hardened gears—formerly case-hardened.
(5) Hardened keys in spindle head—formerly soft keys.
(6) Solid-forged spindle—formerly butt-welded.

Oesterlein-Aurora Drills are built in sizes ranging from 20 to 44 inches—with stationary or sliding head—and with cone or individual motor drive.

New drill catalogue illustrates improved features of Aurora drills. Write for your copy.



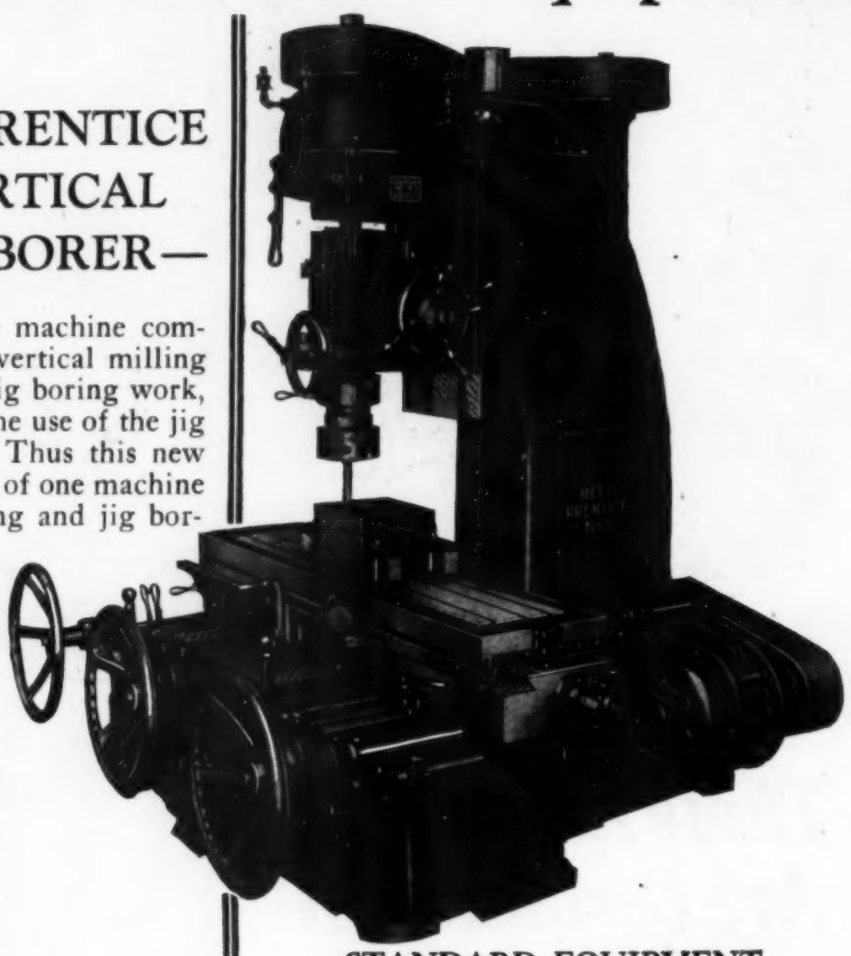
THE OESTERLEIN MACHINE CO., CINCINNATI, OHIO, U. S. A.

OESTERLEIN
OHIO
MILLING
GRINDING DRILLING
EQUIPMENT

A *two purpose* machine that assures lowest investment in equipment cost—

THE NEW REED-PRENTICE MODEL No. 5 VERTICAL MILLER AND JIG BORER—

This new model Reed-Prentice machine combines the power and speed for vertical milling and the precision necessary on jig boring work, which can be handled through the use of the jig boring attachments furnished. Thus this new Reed-Prentice saves you the cost of one machine by handling both vertical milling and jig boring work. Entirely new, with many time and labor features, it offers you new opportunities for cost cutting in your shop.

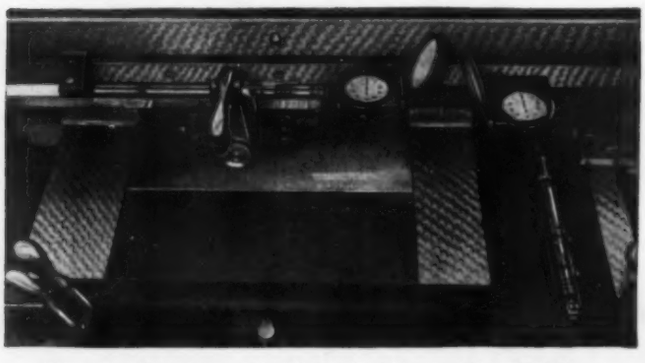


APPLICATION

This two purpose machine is highly efficient on the general run of vertical milling operations. As a jig borer it mills, drills, bores and reams and is especially adapted to milling die shoe bases, milling recesses in die shoe bases for the die blocks, boring out leader pin holes, and for jig and fixture work.

CONSTRUCTION

Its many features of construction include power rapid traverse in either direction; TIMKEN mounting of all main bearings and precision TIMKENS in the spindle, and its unusual range including capacity, speeds, feeds, power, etc. Write for our catalog for complete detailed description of all features.



Close up illustration of longitudinal and cross table indicating devices for jig boring, including dial indicators for measurements to tenths of thousandths and two differential micrometer heads for longitudinal, cross settings and end measurements.

STANDARD EQUIPMENT

Single pulley drive; rapid power traverse for cross and longitudinal feeds; adapter with No. 5 Morse taper inside and N.M.T.B.A. taper outside; power feed to spindle; 5 to 1 compound gearing on cross and longitudinal hand wheels; saddle locking clamp; table locking clamp for boring; spindle drive belt and wrenches.

EXTRA EQUIPMENT

Arrangement for chain or multiple V-belt motor drive without electrical equipment; electrically operated hole locater; rotary table with verniers 20 or 24 inch dia. reading to 5 sec.; No. 10, ¾ inch and No. 20 1½ inch Flynn Boring Heads; arbor for heads with No. 5 Morse taper; ¾ inch boring bar for No. 10 head; 1½ inch boring bar for No. 20 head; 1½ inch arbor for milling cutters No. 5 Morse taper; No. 20, ⅜ - 1 inch Jacobs drill chuck with arbor No. 4 Morse taper; 1 inch dia. spotting tool No. 4 Morse taper; set boring tools for ⅜, ½, ¾ and 1 inch diameters; six parallel bars, 1½, 2½ and 3½ inches; six strap clamps, 4 inches long for ½ inch bolts; six T-bolts 4, 8, 12 inches long with nuts and washers; six step blocks; precision collet attachment N.M.T.B.A. taper; longitudinal and cross feed measuring devices including Ames dials, two B & S differential micrometer heads, set of end measures one each 1 to 12 inches inclusive for measurements to tenths of thousandths; longitudinal and cross feed verniers optional in place of dial measuring device; additional set of end measures one each 1 to 12 inches; sleeves for holding end mills and drills; No. 5 Morse to No. 9 B & S taper shank with draw bar and extracting collar; No. 5 to 4 inch Morse taper with extracting collar; No. 4 to 3 Morse taper with extracting collar.

MACHINE TOOLS

REED-PRENTICE CORP.

WORCESTER MASS. U.S.A.

BRANCH OFFICES:

New York, N. Y.
41 Broad St., Room 715

Detroit, Mich.
3-215 General Motors Bldg.

"Special" Hanson-Process Taps are an important part of our service to industry

Threading problems are so diversified that "special" Taps always will be needed to some extent.

To meet these conditions more fully, and to render a complete service to our customers, we have set aside a portion of our manufacturing facilities for the making of special Taps.

The same close adherence to precision limits of .0001 in. in lead is maintained.

In ordering, kindly give details of thread form and pitch, also lead if multiple, outside diameter, pitch diameter, also specify tolerance limits desired.

Include shank diameter and length, also size of square if desired.

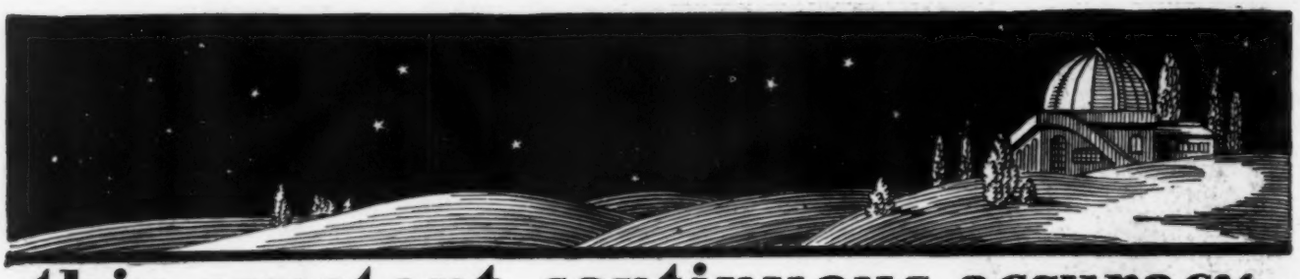
Advise nature of material to be tapped. State whether hole is blind or extends through nut, whether tap is reversed in withdrawing, or can be removed after passing through work and if provision is made for lubricating tap freely.

Prices and delivery cheerfully quoted upon receipt of specifications.

"HANSON" H PROCESS

The Hanson-Whitney Machine Company

Hartford, Conn., U.S.A.



this constant continuous accuracy

The Pratt & Whitney Jig Borer is infinitely superior to other precision borers in that it maintains its accuracy through time and wear.

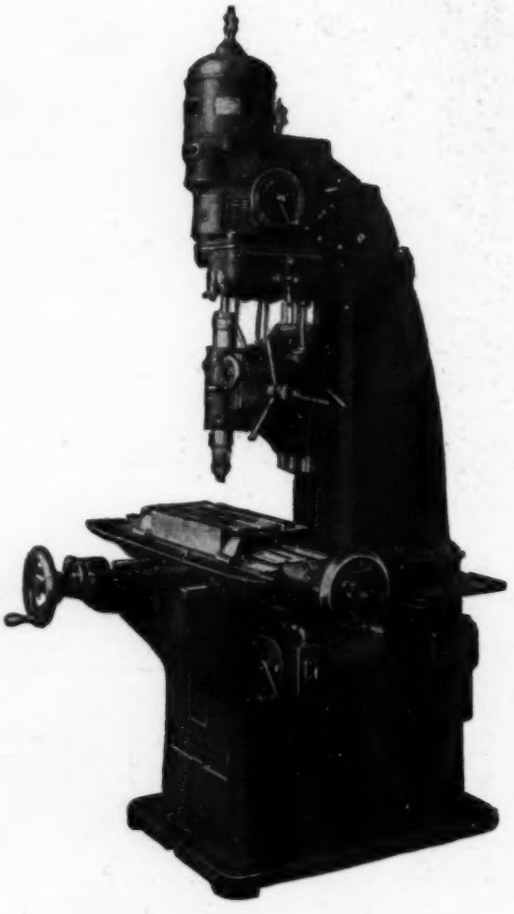
The principle of the Jig Borer's accuracy, the fundamental methods by which it is obtained, never change. In other precision borers, the initial accuracy when the machines are new must deteriorate as wear affects vital parts (such as the lead screws) that determine the accuracy.

Over a long time, even though the lead screw of a P & W Jig Borer may have suffered some slight wear, it will have no effect on its accuracy.

Don't compare *new* machines of different makes when you are buying a Jig Borer. Find out about the old machines. Ask a P & W Jig Borer user who has had five years' accurate locating, boring and checking, if his Jig Borer is still as accurate as the day he installed it. Then find out about other five-year-old precision boring machines.

Some of our customers have re-ordered Jig Borers several times over a period of years. Others, who started with other types, installed a Jig Borer and *they* have re-ordered.

These facts are plain. For constant, continuous accuracy you should have the Pratt & Whitney Jig Borer.



PRATT & WHITNEY
No. 1 JIG BORER
There are several sizes of Jig Borers. Tell us the kind and quantities of your precision boring work and let us suggest the most profitable size for you.

PRATT & WHITNEY CO., *Hartford, Conn.*
Division NILES-BEMENT-POND COMPANY

Sales Offices

BIRMINGHAM	CHICAGO	DETROIT	PHILADELPHIA	SAN FRANCISCO
BOSTON	CINCINNATI	LOS ANGELES	PITTSBURGH	ST. LOUIS
	CLEVELAND	NEW YORK	ROCHESTER	

LOCATES + BORES ✧ CHECKS ✧√

LAPOINTE

Everyone *Knows* About Broaching But Not Enough *Think* About It—

LESS than half the concerns that ought to be using the Broaching process are now cashing in on its benefits.

It possesses exclusive virtues obtainable by no other process. It actually improves the finished surface. In the case of internal gear, sliding parts, bearings—it densifies and burnishes the metal so that the parts are already "worn in" before assembly.

Only in a few cases do Broached parts require supplementary operations, such as grinding, lapping etc.

Get the Broach right and the closest limits, impractical with other methods, are easily held irrespective of the operator's skill. Inspection costs are eliminated other than at long intervals and spoiled work is a rarity.

The limitations of Broaching have not been reached yet. Each day the field is widened. Square, round, hex, splined holes, all sorts of internal gears, and inside serrations can be broached on a wide variety of work.

If you are processing new parts, or changing the design on old parts, it will pay you to see how Broaching can do the job, better, quicker and cheaper.

Our engineering staff will gladly place 30 years' experience at your disposal.

"WHEN YOU THINK OF BROACHING—
THINK OF LAPOINTE."

LAPOINTE MACHINE TOOL CO.

Manufacturers of Broaching Machines, Broaching Tools and Hydraulic Pumps

HUDSON, MASS., U. S. A., and
EDGWARE, MIDDLESEX, ENGLAND

LAPOINTE

PIONEERS IN THE ART OF BROACHING···

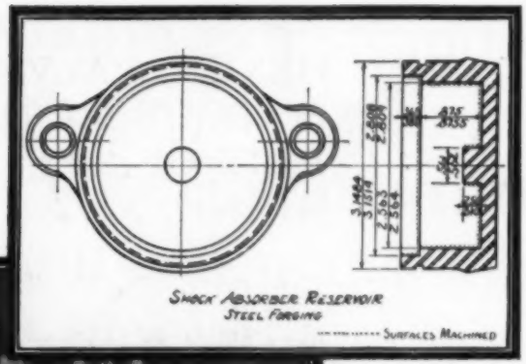
Holding Grinding L
Warner & Swasey I

The National Acme Co., Cleveland, Ohio, uses a battery of 17 Warner & Swasey No. 4 Turret Lathes for the final boring and facing operations on these shock absorber reservoirs.

Each machine produces an average of 33 pieces per hour, holding grinding limits of less than .001 on the inside diameters and less than .0005 on depth. The corners must be sharp and the

The Warner & Swasey

g Limits on y Turret Lathes



bottom face perfectly square with the hole. The surfaces machined are indicated in the diagram above by dotted lines.

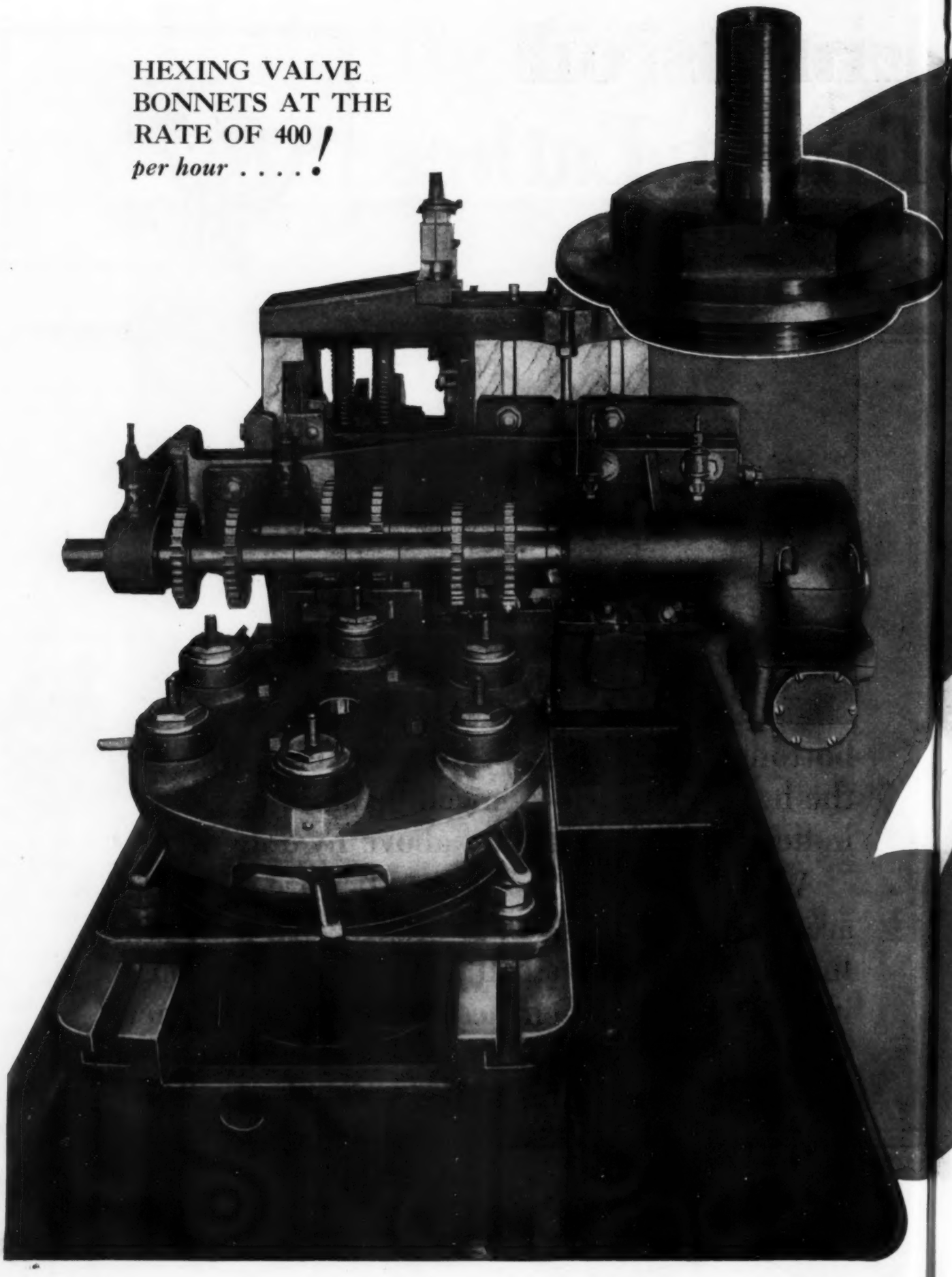
Warner & Swasey turret lathes are rapid and accurate producers. If you have work with close limits in large or small lots it will pay you to install W & S machines. A W & S engineer will give you definite production figures on your work. Call him today.

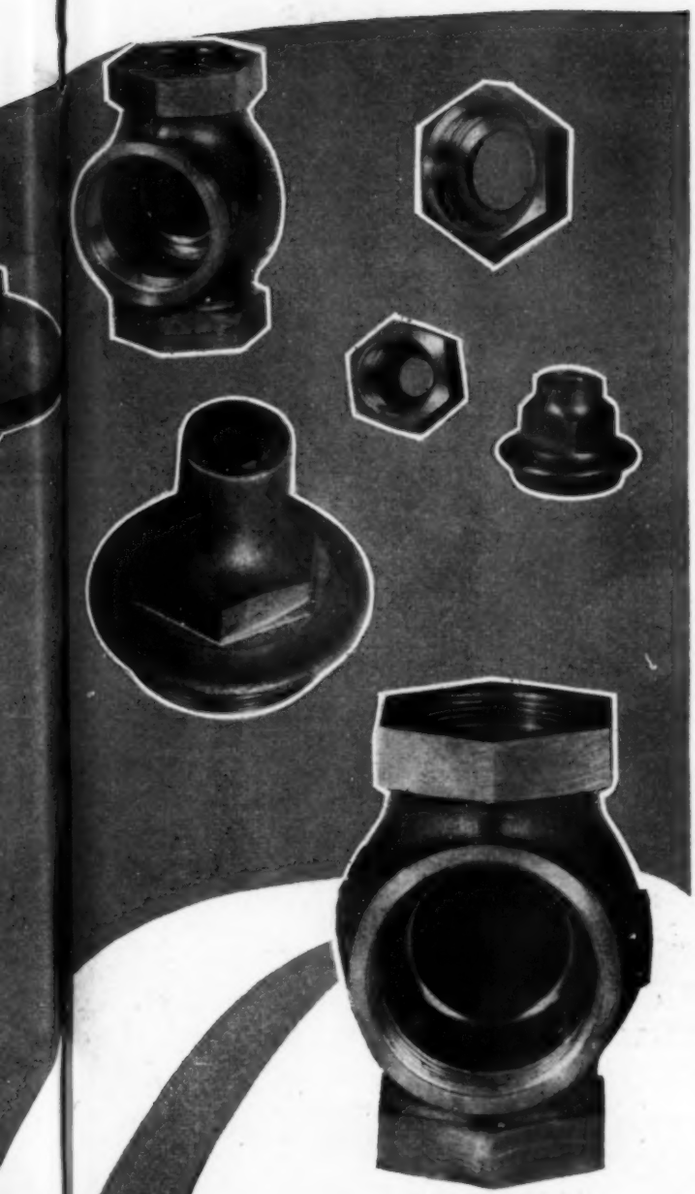
Cleveland, Ohio, U. S. A.

Company

Boston: Chamber of Commerce Building
Buffalo: Iroquois Building
Chicago: 618-622 Washington Boulevard
Dallas: 805 Newell Avenue
Dayton: 518 Mutual Home Building
Detroit: 5928 Second Boulevard
Indianapolis: 1559 North Capitol Avenue
Los Angeles: 1118 Santa Fe Avenue
The Warner & Swasey Co., of Calif.
Milwaukee: 1143 Wells Building
New York: Singer Building
Philadelphia: 5143 Spruce Street
Pittsburgh: Chamber of Commerce Bldg.
St. Louis: 1627 Locust Street
Syracuse: 108 Grant Avenue

HEXING VALVE BONNETS AT THE RATE OF 400 *per hour . . . . !*





Handling this kind of work on ordinary machines is akin to turning out screw machine parts in a lathe

Phenomenally successful performance in other fields has made Producto-Matic methods of milling, the preferred approach to all problems of squaring, hexing, straddle-milling, slotting, slabbing, grooving, form milling, etc.

The picture above shows how a New York manufacturer of brass valves is hexing 1½-in. valve bonnets to the tune of 400 per hour. The dual arbors mount three pairs of side mills—a six-positioned fixture with quick-acting clamps indexes the work so that three parts are milled simultaneously.

All movements—the cutter feed-in and withdrawal as well as the indexing of the fixture, is cam operated virtually wiping out all non-productive time.

As has so frequently happened in so many other lines, the Producto-Matic is generally recognized as the one best way to handle all valve and valve parts in the matter of squaring, hexing and similar operations.

Close limits, FINE finish and ease of set-up and change over, are factors that insure highly satisfactory results on this class of work. Write for illustrated bulletin and ask us to furnish typical production figures on some of your work.

PRODUCTO MACHINE CO.

Bridgeport, Conn.

REPRESENTATIVES

E. A. Harper, 3258 Tuxedo Avenue, Detroit, Mich. Federal Machinery Sales Company, Chicago. S. B. Martin, 1077 Erie Cliff Drive, Lakewood, Ohio. C. H. Gosiger Machinery Company, Dayton. Frank T. Donnelly, Pittsburgh. Crane-Schiefers - Owens, Buffalo, Rochester, Syracuse. Haviland Wright, 3701 N. Broad, Philadelphia, Pa.

PRODUCTO CAM MILLING MACHINE

PRODUCTO READY-MADE DIE SETS

The **PRODUCTO-MATIC**

No Larger In Size Than It Ever Was!

But how much bigger today in content of friendly human relations is this old world of ours as modern progress knits the peoples and the continents more closely together.

American Machinist

wishes its friends
throughout this earth

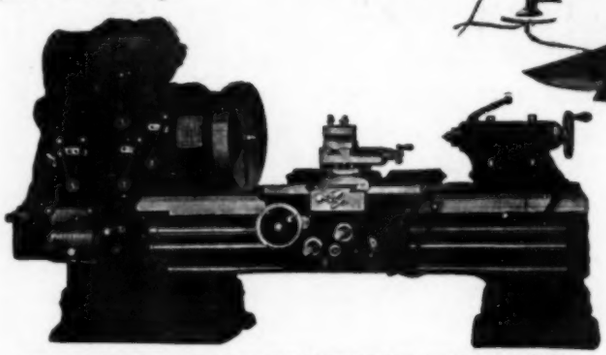
A Happy, Prosperous New Year

You Can't Increase Production by *Passing the Buck!*

CALLING on the foreman of a lathe department equipped with ordinary or obsolete lathes to cut costs and increase output is just another way of "passing the buck." It is almost impossible to increase production, lower costs or create a better product with such equipment.

MONARCH Helical-geared Timkenized Lathes incorporate many cost-reducing features. They can turn cast iron and steel at speeds ranging from 30 to 1200 R.P.M.; they make it possible to secure greater precision, smoother finished work, longer life and greater power economy.

BUT—equip your lathe department with Monarch High-speed Helical-geared, Timkenized Lathes—that will handle the new tungsten-carbide tools to the best advantage—and notice how your foremen respond. Then watch the production curve go up and the cost curve come down.



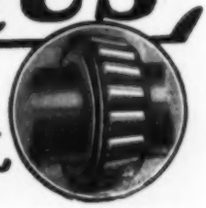
Write for new bulletin "Additional Reasons Why Monarch Lathes Should Be Your Choice."

THE MONARCH MACHINE TOOL CO.
Sidney, Ohio, U. S. A.
New York Sales Office: 857 Graybar Bldg.

Monarch lathes

Helical Gears - Timken Bearings

SMOOTHER..QUIETER..MORE POWERFUL



Where there's smoke there's fire

No. 1—10-in. High Production Gear Hobber.
For spurs, helicals, splines, serrations, etc.

—in practically EVERY plant — where Lees-Bradner No. 1 Hobbers have gone into production, the *general* opinion and *universal* comment is: "that's the BEST Hobber ever designed."

Where there's so much smoke, there *must be* fire. — There *must be* merit—*must be* something worth while . . .

Compact, sturdy, rigid, handy, accessible — a machine that *stays put* and eliminates production headaches — the machine that *assures* high production precision, maximum cutter life and low tool maintenance cost.

—and every statement is backed by production records everywhere!

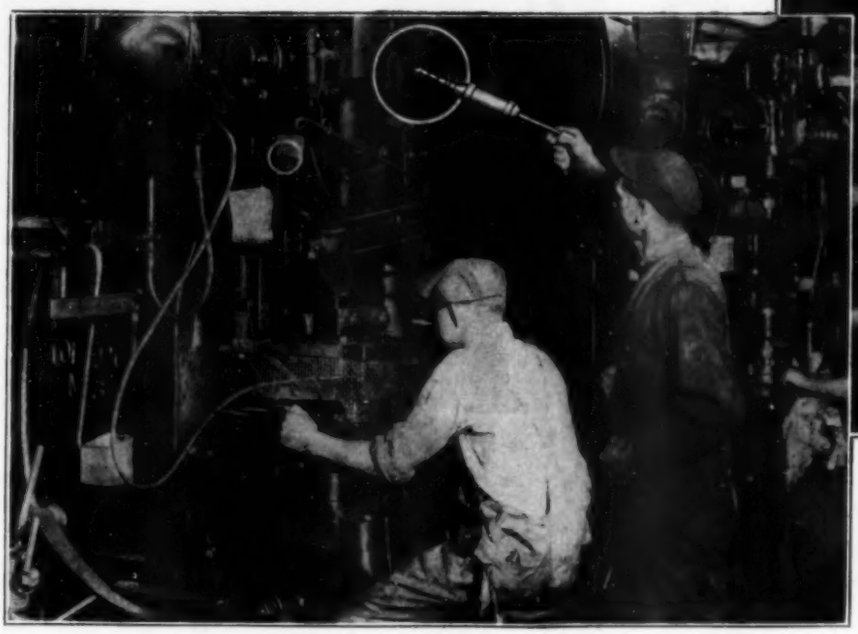
Get Circulars

The LEES-BRADNER CO.

CLEVELAND
U. S. A.

"This Simple Step Increases Machinery Sales," *say Manufacturers*

A Step That Modernizes Lubrication — In Keeping With Modern Changes in Machine Design—Now Demanded by Machinery Buyers



MODERN design in machinery is no longer enough. Today's machinery buyers must have a modern type of lubrication that matches the modern design of the machinery itself. Old-fashioned lubricating methods on today's high speed, high production equipment, is like a whip socket on an automobile.

Thousands of machinery users and buyers are today not only specifying that new machinery must have Alemite high pressure lubrication, but are also rapidly modernizing their present equipment by the addition of Alemite fittings.

To meet this new demand, more than 600 leading manufacturers of all types of machinery have added Alemite high pressure lubrication as standard equipment on the machines they build. This roster is rapidly growing larger. The result has been easier sales and a far readier acceptance on the part of buyers for these machines.

Alemite, since its inception, has kept pace with all engineering advancements in machine design. Today Alemite offers a variety of fittings that definitely obsoletes every oil and grease cup in machinery. Button-head fittings—push-type fittings—pin-type fittings—and now with Alemite's purchase of the Dot fitting and its continuation under the name of Alemite-Dot—every lubrication point on modern machinery becomes easily accessible.

There can be no wasted lubricant with this system, and bearings are cleaned of all grit and dirt when they are lubricated.

ALEMITE

High Pressure Lubrication for Modern Industry

No more oil soaked floors and machinery. No more damaged materials, and above all, machinery repairs, which cut into production, are practically eliminated with this positive lubricating method. You'll even be able to notice an appreciable saving in power.

Write today for complete details of the savings which are now made possible by Alemite.

Alemite Corporation (Division of Stewart-Warner), 2676 North Crawford Avenue, Chicago, Ill. Canadian address: The Alemite Products Company of Canada, Ltd., Belleville, Ontario, Canada.

ALEMITE CORPORATION
(Division of Stewart-Warner)
2676 N. Crawford Ave., Chicago, Ill.
Please send me complete information on Alemite.

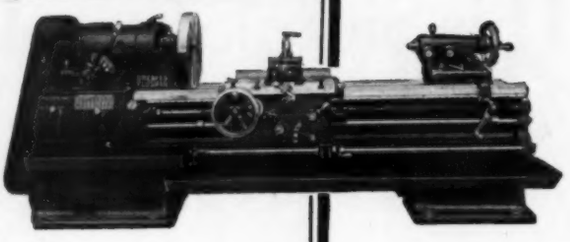
Name.....

Address.....

City.....*State*.....

1652

A STRONG WIDE RANGE TAPER ATTACHMENT



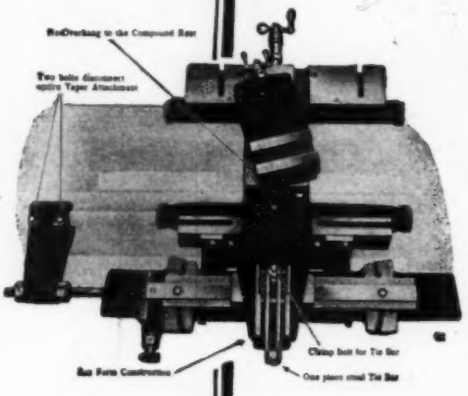
for G-K Single Lever Control

L A T H E S

14, 16, and 18-inch lathes, maximum taper 4 inches. Turns at one setting 24 inches.

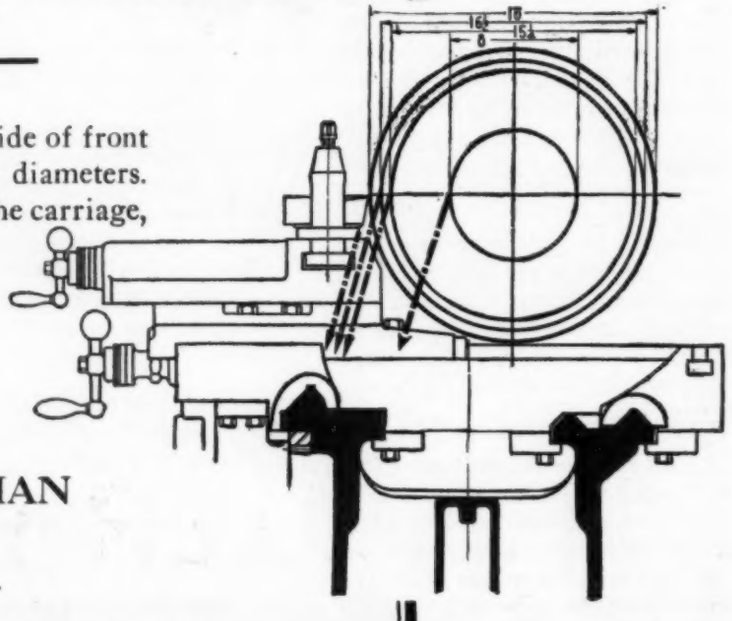
20, 24 and 30-inch lathes, maximum taper 6 inches. Turns at one setting 26 inches.

The two combined brackets, (upper and lower) are bolted to the back of carriage; the long slide, swivel slide bar and gibbed sliding shoe being fitted between planed and scraped surfaces of these brackets. This important feature and substantial construction ensures rigidity and relieves the dove-tailed slides of any twisting strain.



G-K Correct Tool Pressure Angle Produces Better Work—

Note how the tool pressure reacts inside of front Vee even when turning these large diameters. This eliminates possible buckling in the carriage, prevents the apron from getting out of alignment and does away with chatter marks.

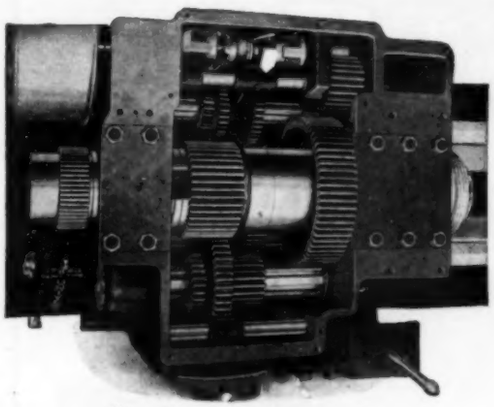


For all the data on G-K Lathes, write for the G-K Catalog.

The GREAVES-KLUSMAN TOOL CO.
Cincinnati, Ohio, U. S. A.

As easy to handle as a small machine

ACME 17 and 4½



Heavy Type Universal Turret Lathe

This Cincinnati Acme is a big, husky machine with head stock and base cast integral—accuracy is certain.

Yet—this machine is easy to handle—operator has but two controls to think about—complete control is maintained from operator's natural working position.

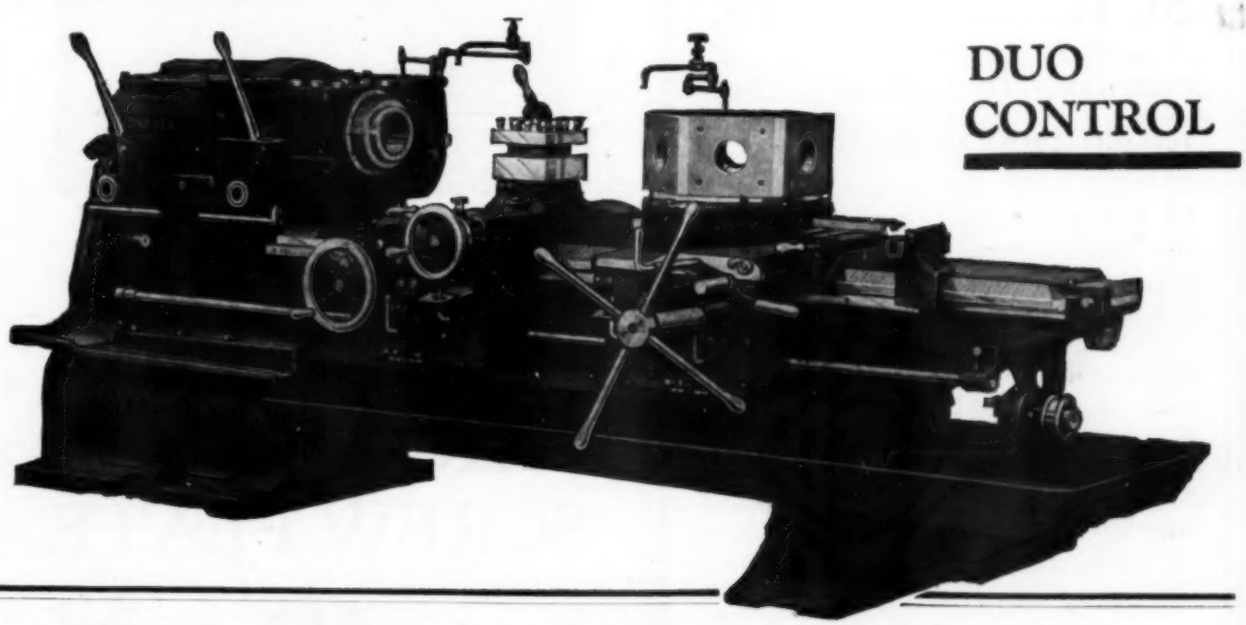
It is this convenience plus rugged, sturdy construction that produces more work at lower costs. Get the facts. Write for bulletin.

Open the Head and you'll find

TIMKEN BEARINGS
on all driven shafts

MULTIPLE SPLINE SHAFTS
for sliding gears.

TWIN DISC CLUTCH
gears heat treated and oil hardened



DUO CONTROL

THE ACME MACHINE TOOL CO.

4955 SPRING GROVE AVE. **CINCINNATI, OHIO**

Gray Planers

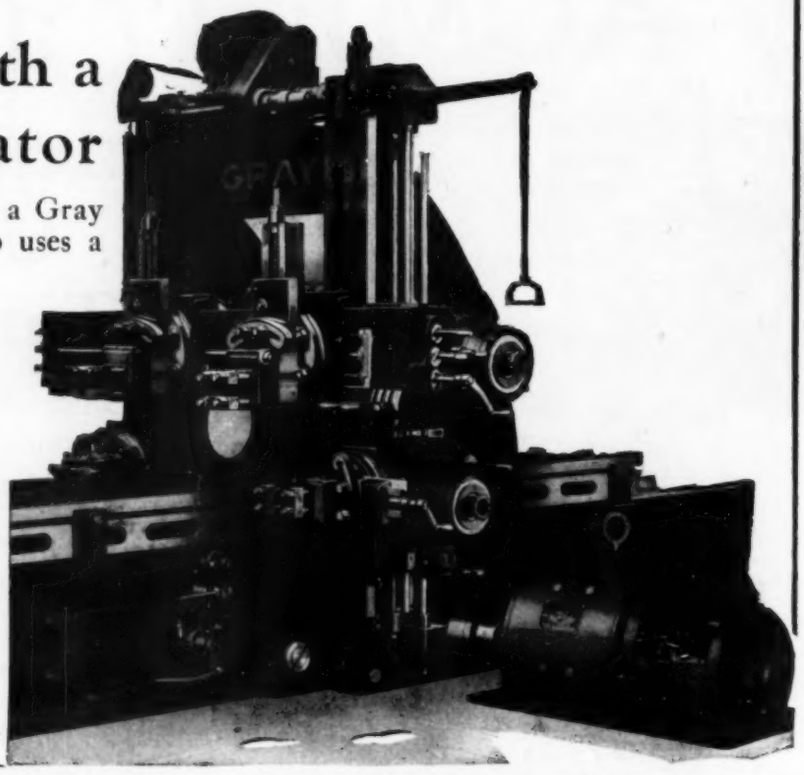
An Interview with a "GRAY" Operator

is the next-best thing to running a Gray Planer yourself. The man who uses a Gray Planer, day after day, can tell you about the better quality work it does, the increased quantity of work and the many conveniences that assist him in its handling.

There are Gray Planer users near you. Let us tell you where.

Maximum Service Planers: Open Side and Double-Housing

Manufactured by
THE G. A. GRAY CO.
Cincinnati, Ohio



The Only Style SCREW PLATE

ranging in cutting sizes up to two inches - - - -

Greater adjustment above and below size can be obtained with this CARD Screw Plate. Thus it is particularly useful on emergency jobs.

It is excellent for cleaning up bruised or rusty threads. Also for cutting bolts requiring either a tight or loose fit.

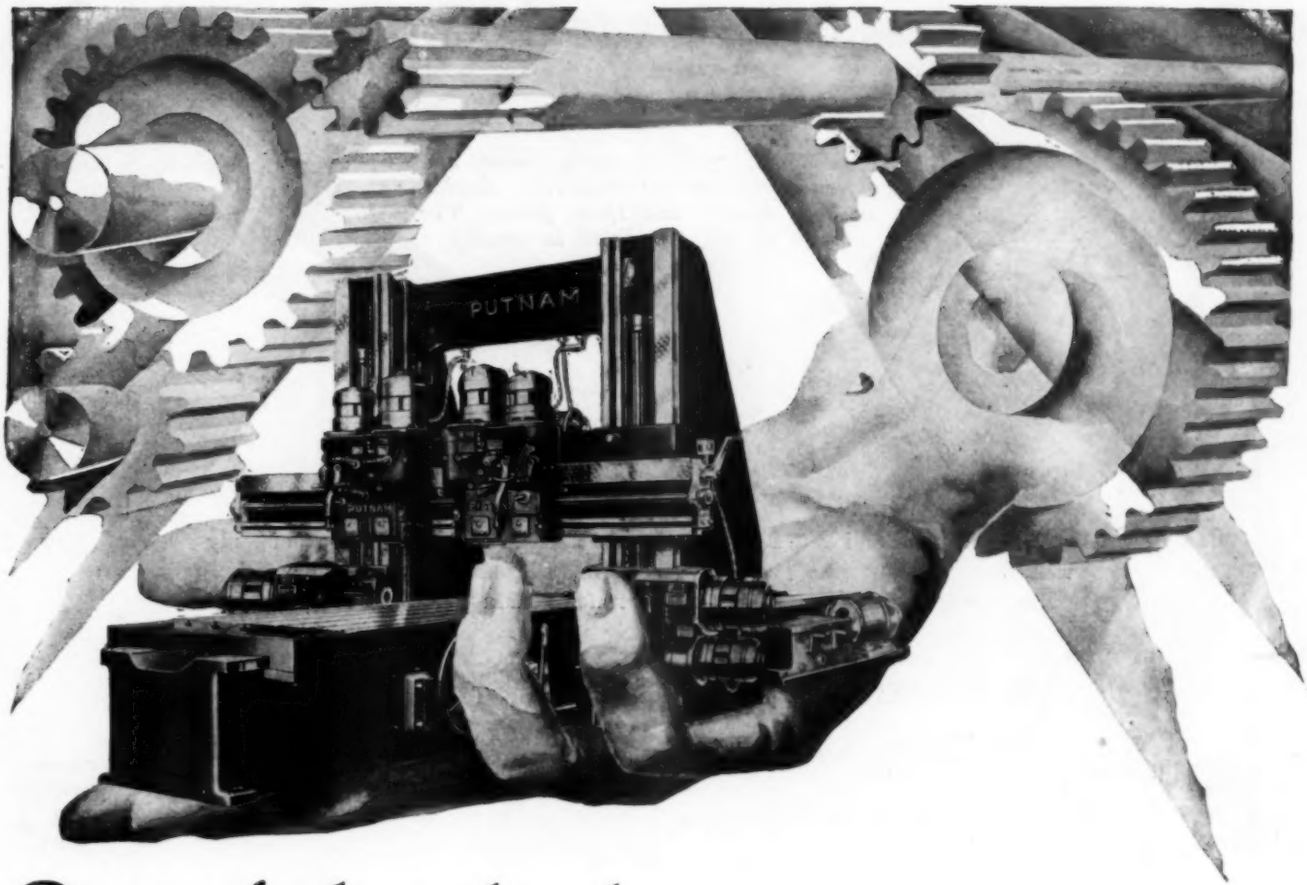
CARD Machinist's Screw Plates can be supplied in all assortments from ¼ to 2 inches, either U.S.S. or Whitworth Standard forms of threads.

Catalog No. 32 lists this and other CARD Quality Screw Plate Sets. Ask for a copy.

The CARD Quality

MACHINIST'S SCREW PLATE

CARD
S.W. CARD MFG. CO.
DIVISION OF UNION TWIST DRILL CO.
MANSFIELD, MASSACHUSETTS, U.S.A.



Out of the shadow . . .

of gears and shafts

IN DESIGNING this Putnam Planer Type Milling Machine, the older principle of applying power by means of a single motor, through a circuitous route of cumbersome gears and other complex mechanism, has been done away with. Thus eliminated, too, is a multitude of extra costs of maintenance and operation . . and the danger of tie-ups.

This machine . . equipped with unit heads . . is simplicity itself. One motor supplies power to the spindle; the other supplies power to feed and head traverse mechanisms.

Glance at the additional points listed on this page . . and send for particulars on the reduced costs and increased efficiency to be expected from this machine.

PLANERS
Open Side,
Double Housing

BORING MACHINES
MILLING MACHINES
DRILLING MACHINES

•

HEAVY DUTY
MACHINE TOOLS
For Industrial and Railroad
Shop Service

•

SPECIAL PURPOSE
MACHINES

16 spindle speeds, 12 head feeds, 12 quill feeds . . in either direction. Heads operate in vertical or horizontal position. Flood lubrication. Roller bearing equipped.

Manufactured at
PUTNAM MACHINE WORKS, Fitchburg, Mass.
Owned by
MANNING, MAXWELL & MOORE, Inc.
General Offices: 100 E. 42nd St., New York City

Branches: Chicago Detroit Philadelphia St. Louis

Representatives:
Arch Machinery Co., 1005 Park Bldg., Pittsburgh, Pa.
Overkamp Machinery Co., Rialto Bldg., San Francisco, Cal.
International Equipment Co., Ltd., Royal Bank Bldg., Montreal, Canada

MANNING, MAXWELL & MOORE, Inc.

LONG SERVICE LIFE

Experienced craftsmen sing their praises and so will you if you'll give them a trial. Available in both straight and spiral flutes. The range of sizes are listed in catalog No. 20

Butterfield Expansion Hand Reamers meet the peculiar requirements uncommonly well. Special heat-treating methods give them a toughness that takes downright abuse to cause breakage while the adjustments make it easy to obtain and *retain* the correct settings.

BUTTERFIELD & CO. DIVISION UNION TWIST DRILL CO.

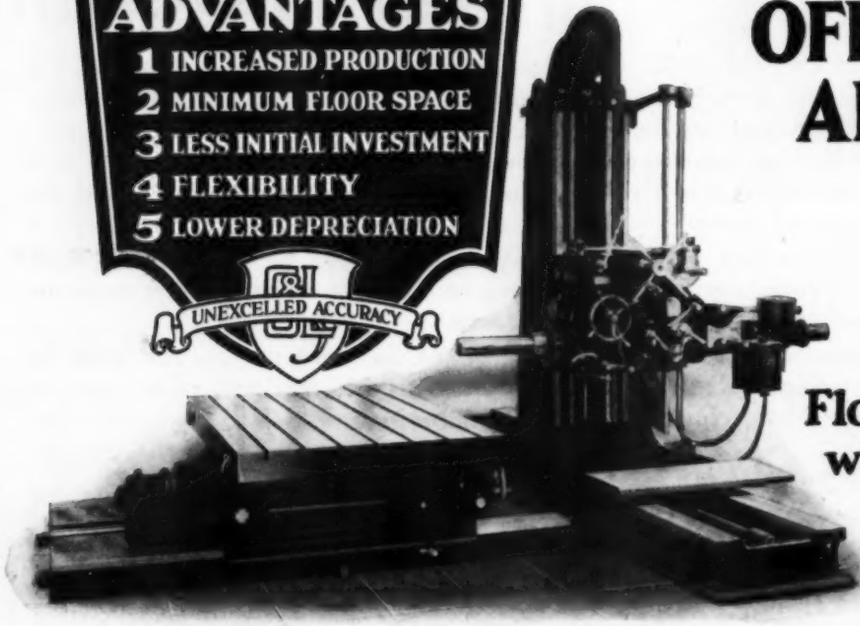
Derby Line, Vt., U. S. A. Rock Island, Quebec, Canada. Stores: New York, 62 Reade St. Chicago, 11 So. Clinton St. Detroit, 406 E. Woodbridge St. Toronto, 196-198 Adelaide St., West. Montreal, 111 St. Paul St., West.

BUTTERFIELD THE BETTER TOOLS

BUTTERFIELD THE BETTER TOOLS

The G&L METHOD OFFERS THESE ADVANTAGES

BIG ADVANTAGES
1 INCREASED PRODUCTION
2 MINIMUM FLOOR SPACE
3 LESS INITIAL INVESTMENT
4 FLEXIBILITY
5 LOWER DEPRECIATION
UNEXCELLED ACCURACY



Floor Type Machine with Precision Power Revolving Table

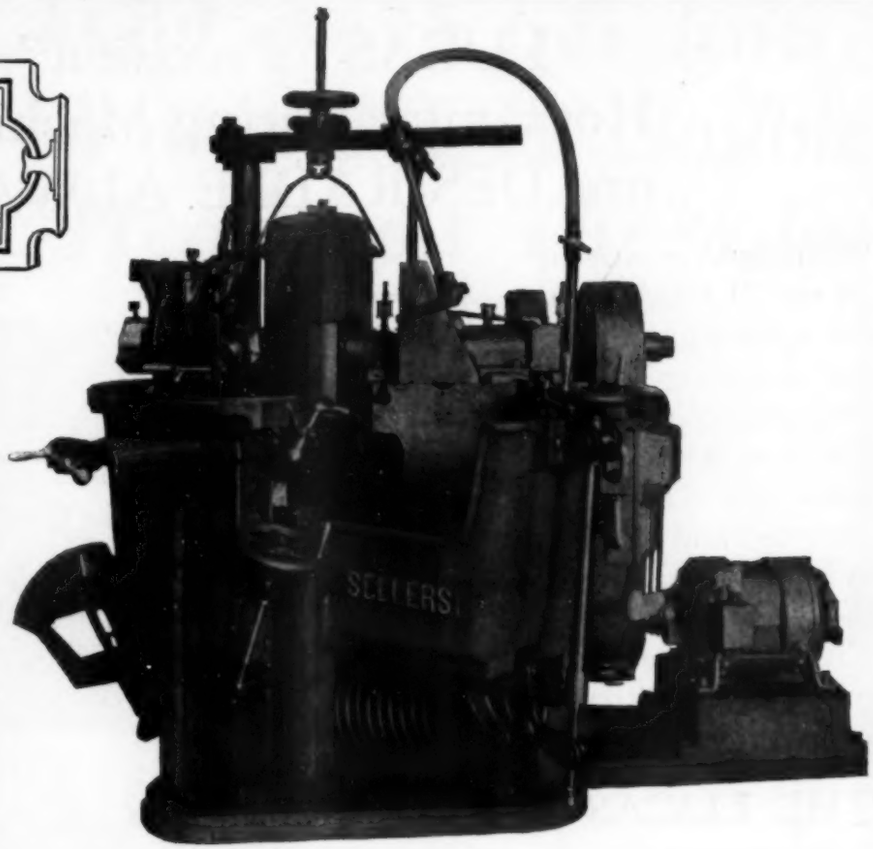
Specialists in Horizontal Boring, Drilling and Milling

GIDDINGS & LEWIS MACHINE TOOL CO.

Founded 1859

FOND DU LAC, WISCONSIN

SELLERS
TOOL GRINDER



For Uniform Tool Grinding

The Sellers Tool Grinder produces any desired shape of tool from rough forgings and is equally efficient in retouching the daily run of dull tools. It saves both tool steel and cutting time by grinding away only enough metal to exactly duplicate the correct cutting edge.

Operating handles are conveniently grouped for rapid adjustment and easy operation. The scale graduations, indicating angles of rake, clearance, etc., are large and easily readable.

Sellers Tool Grinders are built in two sizes—for tools up to 3″ x 3″ section and for tools up to 2″ x 1½″ section.

Let us send complete descriptions of their many distinctive features.

We also manufacture:

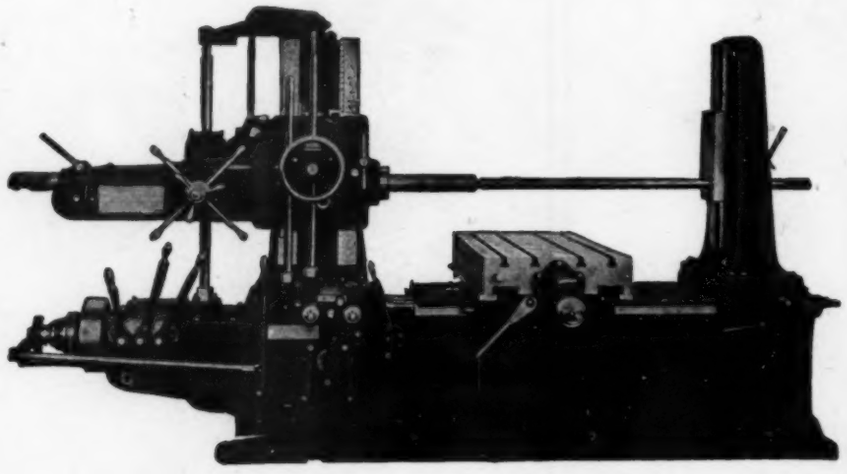
Planer-type Milling Machines; Floor Boring Machines; Large Boring and Turning Mills; Planers; Drill Grinders; Railway Shop Tools; Sand Aerators for foundries.

WM. SELLERS & CO., Incorporated

1600 Hamilton Street **Philadelphia, U. S. A.**

LUCAS *"Precision"* Horizontal Boring Machines *are* DESIRABLE ALWAYS

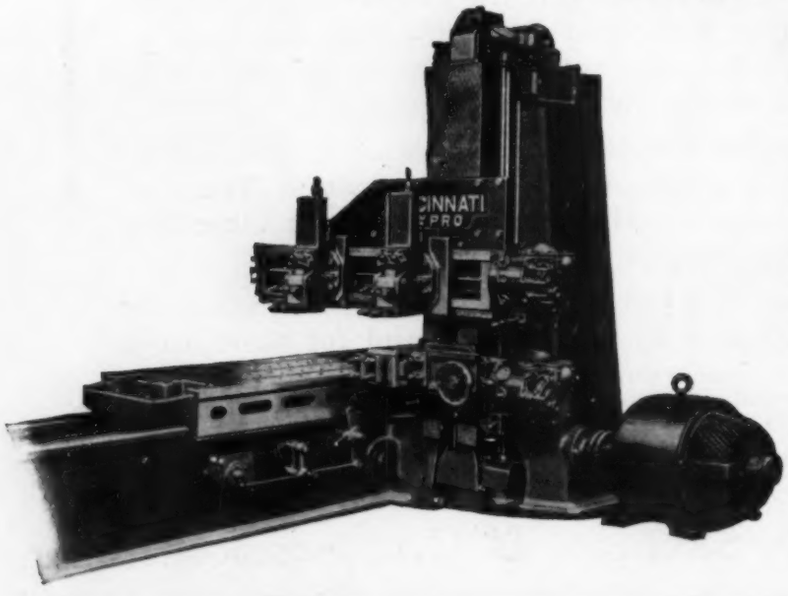
We heard recently of an old "LUCAS" on the second hand market bringing nearly 25% more than we got for it new, 20 years ago. They are designed and made to WEAR WELL and their GOOD REPUTATION gives them unusually high resale value.



THE LUCAS MACHINE TOOL CO., Cleveland, Ohio

CINCINNATI HYPRO OPENSIDE PLANERS

make unusual jobs easy because of these features



Selective Dial Feed.

Instantaneous Rail Lift.

Inner Guide Box Table.

Double Length Enclosed Bed.

Forced Lubrication to Vees.

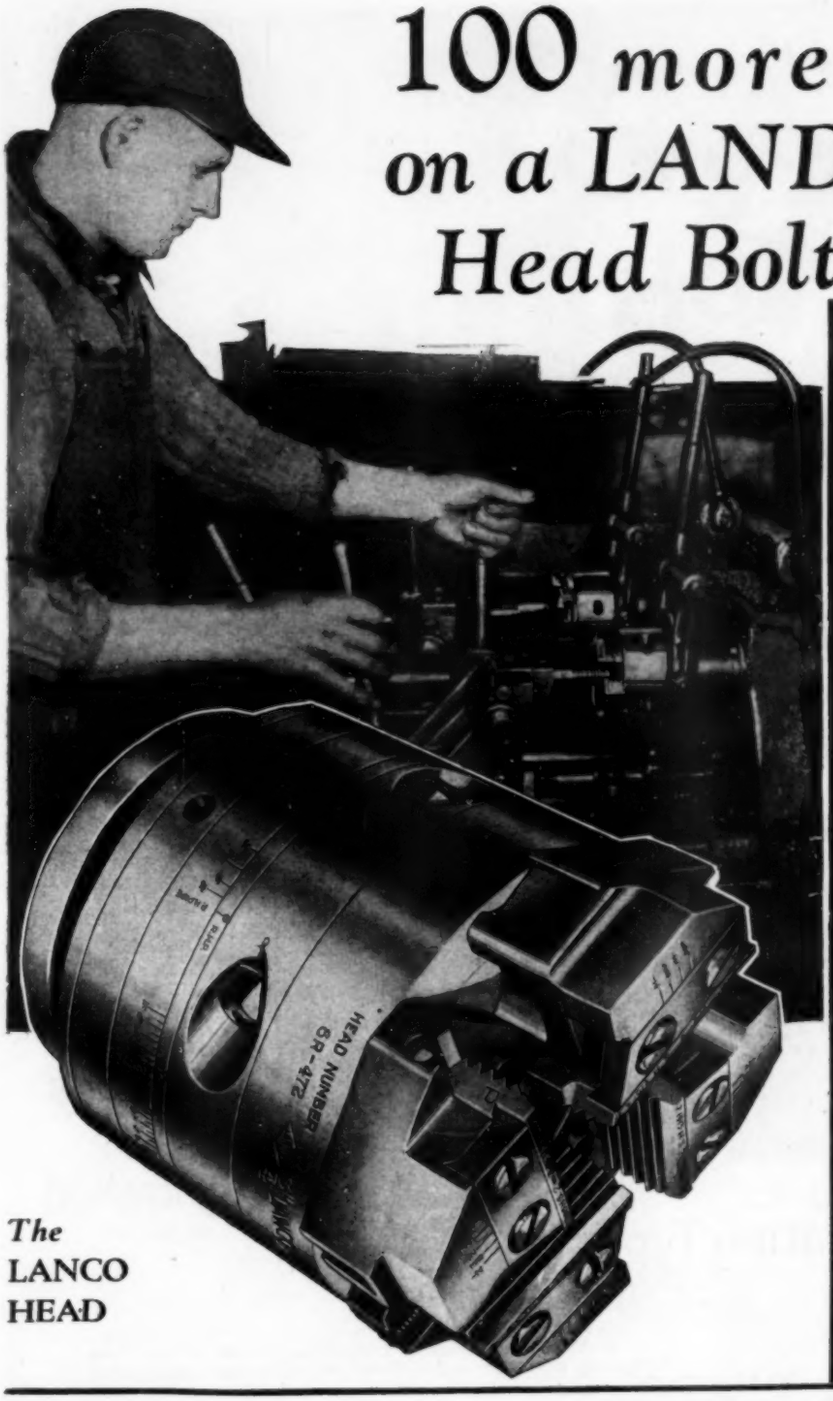
Rapid Power Traverse to Rail and Side Heads.

Pressure Lubrication to the Shaft Bearings.

Single Turn Rail Clamping Device.

The Cincinnati Planer Co.
Cincinnati, Ohio

100 *more per hour on a* LANDIS Double Head Bolt Threader!



The LANCO HEAD

It's the old story—LANDIS Threading equipment scores again! Out in Cleveland, The Atlas Bolt and Screw Company were only getting 300 threaded ½ inch Cylinder Head Studs per hour, on their former threading equipment. Threading costs were too high — something had to be done—and they did it!

Here the installation of a ½ inch LANDIS Double Head Bolt Threader equipped with LANCO HEADS, jumped production 33-1/3 per cent and spoilage was reduced to the minimum with an added saving.

No matter what your threading problem may be, LANDIS Threading Engineers can show you the way to a profitable solution with LANDIS Threading Equipment. Ask them!

LANDIS MACHINE COMPANY
Waynesboro, Pa.

Agents in all principal cities of the world
Detroit Office:
5928 Second Boulevard
Cleveland Office:
504-505 Marshall Bldg.

LANDIS REG. U.S. TRADE—MARK PAT. OFF.

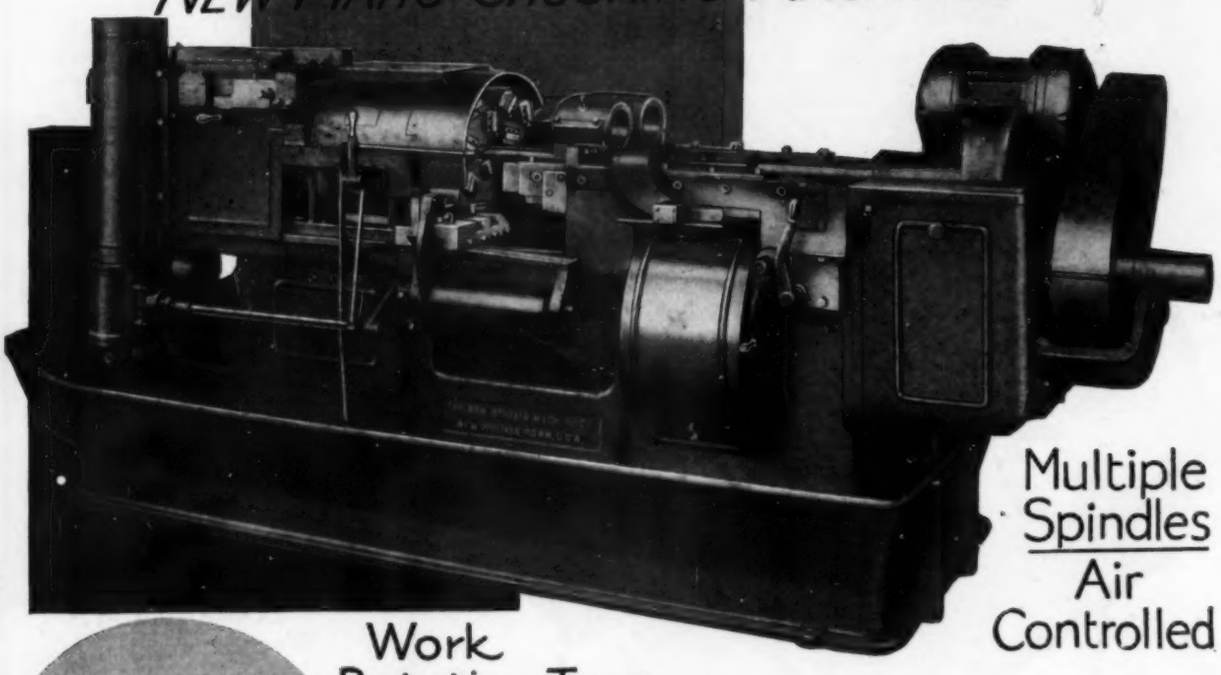
LANDIS *threading equipment*

REMEMBER THIS—

When you see a chaser of this design, it's a Landis! No other chaser is like it. No other chaser offers its advantages—free shear cutting action, less cutting strain and thread distortion—variable rake angle assures smooth well formed threads—accurate lead always maintained, not necessary to grind into leading portion—grinding done on cutting edge only, can be used for "close-to-shoulder" work throughout its entire life—ten to twenty times the life of hob chasers!

Super Production

NEW BRITAIN NEW-MATIC CHUCKING MACHINES



Multiple Spindles Air Controlled

Work Rotating Type

A Multiple Spindle Chucking Machine of work rotating type, air controlled. Made in four sizes, with four and six tool slide positions and three cross slide positions.

The New-Matic is adapted for automatic machining of castings, forgings and second-operation bar work. Work performed on four or six pieces simultaneously and time is that of longest single operation or subdivision thereof.

Air control permits operator to tend two machines without undue exertion. Chucking capacity 4 ⅜ to 8 inches. Weights from 7600 to 12,250 pounds.

NEW BRITAIN · GRIDLEY · NBG · AUTOMATIC MACHINERY

THE NEW BRITAIN-GRIDLEY MACHINE COMPANY

New Britain, Connecticut

What uniformity *means to you*

"Licking" the job is only the start of the battle. It's the ability to keep it licked week after week that cuts costs.

Keeping the threading jobs licked depends on the ability to duplicate *exactly* the tool that originally licked the job. And you'd be surprised to know how hard that is.

Here at *Greenfield* our records on special threading jobs are really complete. We can duplicate any Acorn Die, for example, a week or five years after it goes out—duplicate it as regards steel, heat treatment, cutting rake, clearance — everything. And the buyer gets duplicate performance. His job stays licked.

If you, as you read this page, could see the blueprints and records on Acorn Dies that have been made for you and for other manufacturers, you would have a better understanding of why *Greenfield* tools are reliable and uniform in their performance.

GTD Greenfield

Small Tools
Taps and Dies
Screw Plates
Twist Drills
Reamers
Gages
Screw Slotting Cutter
Pipe Tools

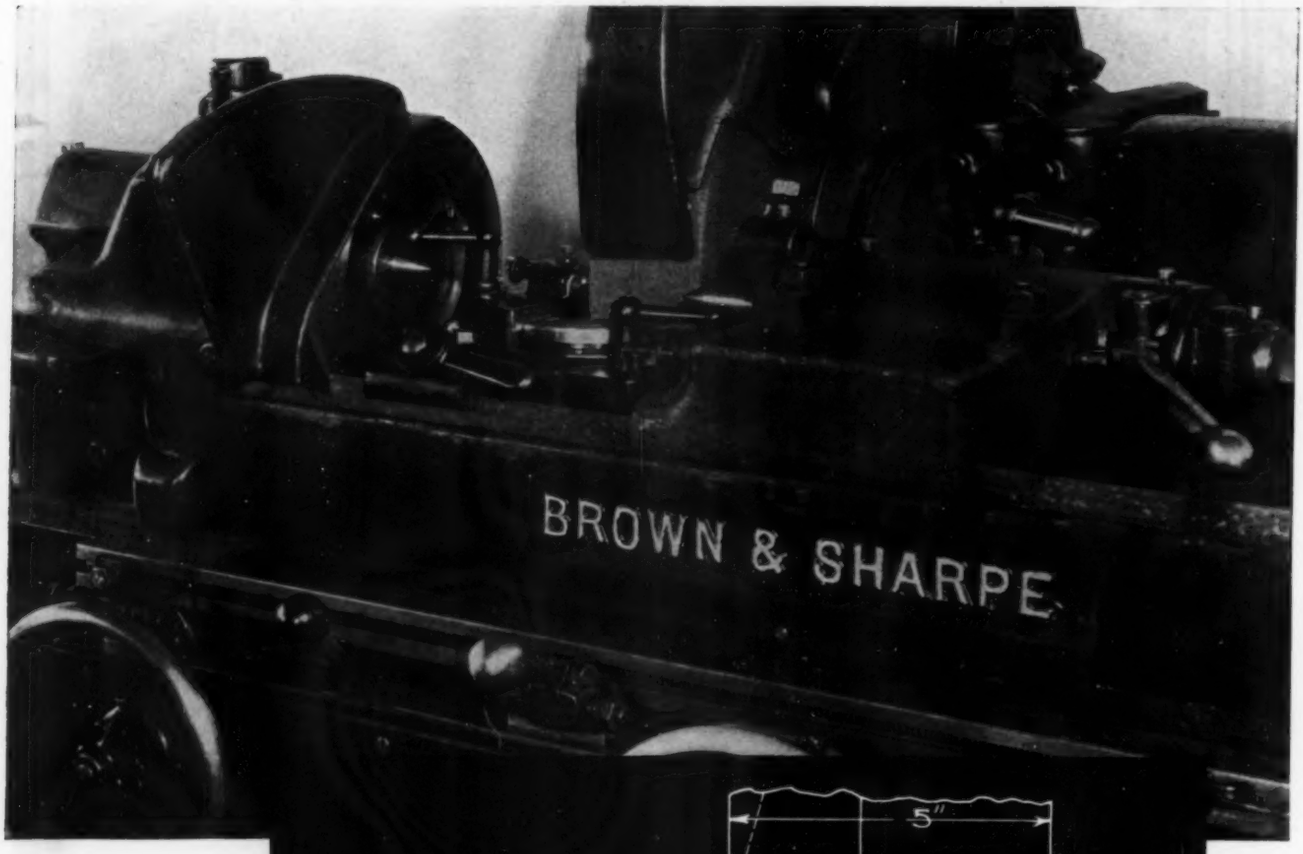
GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

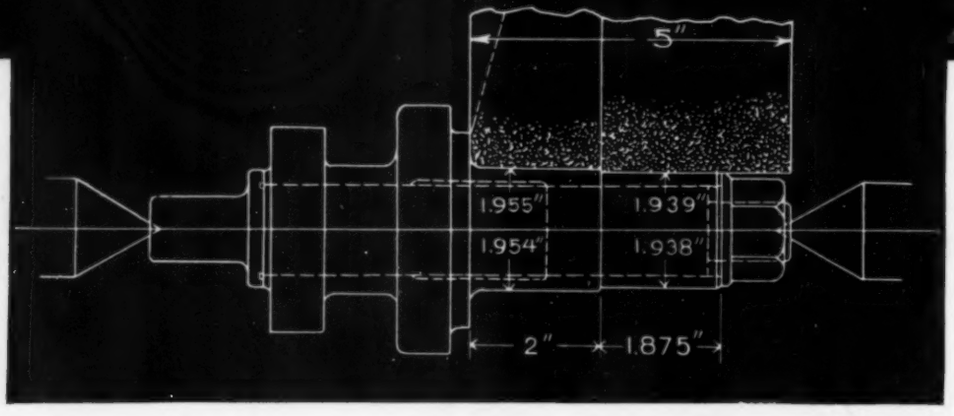
New York: 15 Warren St. Chicago: 611 W. Washington Blvd. Detroit: 228 Congress St., W.

Canadian Plant:
Greenfield Tap & Die Corp. of Canada, Ltd., Galt, Ontario

European Office:
Greenfield Tap & Die Corp., Ltd., 139 Queen Victoria Street, London, E. C. 4

Grinding two diameters *and a*





MACHINE	No. 30 Plain Grinding Machine
PART	Transmission Countershaft
MATERIAL	Heat-treated Steel
OPERATION	Grind Two Diameters and Radius
STOCK REMOVED	.010″ on Diameter
SPECIAL EQUIPMENT	Work Arbor, Truing Device, Dial Stop for Table
TIME PER PIECE	52 seconds

a radius *to* close limits *in* one cut

—a stepped wheel "steps up" production on this job on a Brown & Sharpe No. 30 Plain Grinding Machine

BY using a special formed wheel two diameters and a radius are ground to tolerances of ± .0005" on this piece, a transmission countershaft of heat-treated steel.

The highly satisfactory production obtained is due in part to the special truing device designed by the Brown & Sharpe Grinding Service department for the formed wheel. Both the diameters and the radius on the wheel are readily dressed with this device, which is shown in use in the illustration.

Special fixtures designed by our Engineering Service, for use on machines from the "30 series" are helping many manufacturers to faster and better grinding.

Specifications of any size in this series will be sent at your request. Ask our representative to tell you more about them.

The "30 series"
BROWN & SHARPE
PLAIN
GRINDING MACHINES

No. 30 No. 32
No. 33 No. 35

MODIFIED MACHINES

Nos 30A, 32A, *and* 33A
(Power Table Feed for Wheel Truing, and Power Cross Feed)

Nos. 30B, 32B, *and* 33B
(Hand Table and Cross Feeds)

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

"Here's How To Make Forty Per Cent" —The Super

"'Pea-soup fogs, auto accidents, paralyzed navigation by water, delayed railroad traffic and air-mail service', says the New York newspapers. Quite appropriate accompaniment to the recent Wall Street gloom, eh Kennedy?"

"Yes, Hawkins, and quite as localized. There's certainly no gloom around *our* shop since we decided on our full-steam-ahead program."

"Right, and now that our board of directors have pulled their surplus out of Wall Street, we'll have more steam in 1930, than we did in '29. Why these birds couldn't see that we could make 40% for them, with money invested in new equipment, is more than I can see."

"Yes, Hawkins, this week's message from the Machine Tool Builders' Association puts it very nicely—'Good Bonds Pay 5%, Good Machine Tools Pay 40%'."

"Take this machine for rough and finish milling 4,200 bearing caps per eight-hour day, for example. Just imagine the saving *that* machine would make over the way we are now doing a similar operation. Believe me I'm after such a machine. Going to send them a sample part in the next mail."

"Oh, you mean the one in this ad with the picture of Eli Whitney."

"Yes, Kennedy. It sure is remarkable what that boy Whitney started. Found skilled mechanics scarce, so he invented a jig! 'To err is human, only machines are precise'."

"You've got to expect a certain percentage of errors in operations performed largely by hand on obsolete machines. Modern equipment, with the skilled mechanic free to put his skill and brains in the set up and in an occasional check of the results, sure is the sensible way to cut down on the human errors. And the only way I know to make forty per cent."

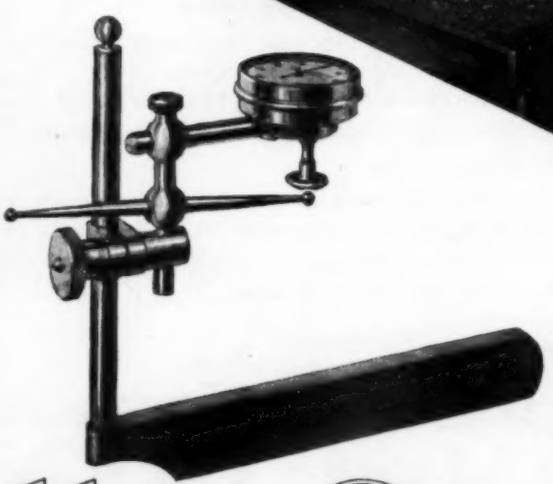
The above is typical of conversations that are taking place in shops and offices all over the country, demonstrating the fact that production and engineering executives are the ones who decide on the purchase of new equipment for their plants, as well as parts and materials for their products.

"Sensitive as a cat's whisker"

That is what this man says as he watches his Starrett Universal Dial Tester No. 196. It's one of the most generally useful tools in the shop—adjustable dial for quick readings—hardened steel contact points—quickly and easily set for any position—the superior convenience, accuracy and durability you expect of a Starrett Tool.

Send for the Starrett Catalog No. 24 "C" describing over 2500 Starrett Tools.

THE L. S. STARRETT CO.
World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
ATHOL, MASS., U. S. A.



Starrett
No. 196 Universal
Dial Test Indicator

Use Starrett Tools

Under gruelling service conditions—

Du Lux finish stands up!

AS a conclusive durability test of Du Lux, a well-known manufacturer of road machinery applied this modern machinery finish to 30 road machines. The finish was sprayed directly on the metal.

After 6 months' exposure in an open lot—in temperature as low as 32° F. below zero — these "test" machines were especially chosen to fill orders, because, as the manufacturer said, "They had so much better appearance than those in our own enamel, which had not been out nearly so long."

Similar tests of Du Lux by many manufacturers of widely different machinery products have proved Du Lux a superior finish for countless exacting usages.

This unique du Pont product offers valuable advantages both in application and in the complete finish. It brushes easily, sprays readily and dries tack-free in a few hours. It combines unusual hardness with a permanent elasticity. It resists brittling when subjected to heat or temperature change—and is unharmed by gasoline and oil.

No matter what your machinery product is—it will pay you to investigate Du Lux. Further information will be gladly supplied on request.

Other du Pont Materials For Any Finishing System

Du Pont Machinery Filler and Machinery Sealer have unusual oil-resisting qualities. Duco gives a hard, durable finish that is not attacked by oil or alkali. And du Pont Machinery Enamels meet the highest standards for these types of finish.

Let du Pont engineers study your specific problems. They will show you where du Pont materials can bring definite advantages over finishes you are now using. Write for further details.

DU PONT

REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & COMPANY, Inc.

Industrial Finishes Division, Parlin, N. J.

Everett, Mass. Chicago, Ill. San Francisco, Cal.

PERFECT CASTER MFG CO.

LONG BEACH, CALIFORNIA

April 1, 1929

Subject: Kantlink Lock Washers

Gentlemen:

Being a manufacturer of large quantities of casters of which the more popular type require a lock washer in the wheel assembly, the inconvenience and loss of time plus the tedious work of untangling the so called standard lock washer was so apparent that we considered using the Kantlink washers.

Of course, there was the subject of cost involved and we thought perhaps that the additional cost would more than offset this trouble, but after using several hundreds of thousands of Kantlink lock washers and knowing that the additional cost was more than absorbed by the benefits and speed gained, we therefore would not consider going back to the so called standard type of lock washer which in our assembly work was handled more in the shape of clusters than in individual lock washers.

We heartily endorse the Kantlink lock washers and have nothing further to say except that we are entirely satisfied.

Yours for PERFECT satisfaction,
PERFECT CASTER MFG. CO.

Superintendent

ACMcG:AP

". . . . after using several hundreds of thousands of Kantlink . . . . and knowing that the additional cost was more than absorbed by the benefits and speed gained . . . . we would not consider going back to the so called standard type of lock washer . . . . We heartily endorse the Kantlink lock washers . . . ."

It will pay you to write today for information about Kantlinks to any one of the manufacturers listed below.

"Being a manufacturer of large quantities of casters of which the more popular type require a lock washer in the wheel assembly, the inconvenience and loss of time plus the tedious work of untangling the so called standard lock washer was so apparent that we considered using the Kantlink washers.

"Of course, there was the subject of cost involved and we thought perhaps that the additional cost would more than offset this trouble, but after using several hundreds of thousands of Kantlink lock washers and knowing that the additional cost was more than absorbed by the benefits and speed gained, we therefore would not consider going back to the so called standard type of lock washer which in our assembly work was handled more in the shape of clusters than in individual lock washers.

"We heartily endorse the Kantlink lock washers and have nothing further to say except that we are entirely satisfied."

Made and sold under license by the Kantlink Manufacturers:

The American Nut & Bolt Fastener Co.
Pittsburgh, Pennsylvania

Beall Tool Co.
East Alton, Ill.

The Mansfield Lock Washer Co.
Mansfield, Ohio

The National Lock Washer Co.
Newark, N. J., Milwaukee, Wis.

The Positive Lock Washer Co.
Newark, New Jersey

The Reliance Manufacturing Co.
Massillon, Ohio

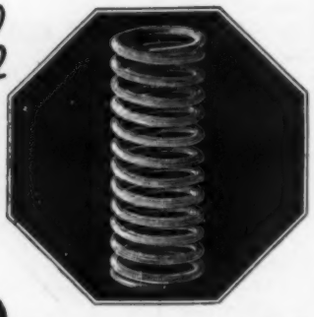
3083
3091

KANTLINK TRADE MARK SPRING LOCK WASHERS DO NOT TANGLE DO NOT RUST

THEY PAY THEIR ENTIRE COST IN TIME SAVED - SOMETIMES EVEN MORE

WISSCO Valve Springs

an 8th Reason



for their exceptional qualities

Commercial manufacturing limits compared with valve spring limits

STANDARD variations in manufacturing dimensions have been established. Springs coiled to more rigid specifications, such as valve springs, require skillful operators and close inspection during coiling.

The Wickwire Spencer Steel Company uses up-to-date coiling equipment as well as semi-automatic testing devices to assure a careful final inspection of valve springs.

Watch for the 9th of 10 Reasons Why WISSCO VALVE SPRINGS Are Exceptional.

WICKWIRE SPENCER STEEL CO.

41 East 42nd Street

New York City

WISSCO VALVE SPRINGS

UNIQUE

TRADE MARK REG'D.

THIN LEAD COLORED PENCILS

Make fine lines in Color

for
Sketching
Drafting
Map-Coloring
Charting

. . . a VENUS Pencil Factory product, made to the same standards that keep VENUS Pencils "the largest selling quality pencil in the world."

Ultramarine Blue
Field Green
Olive Green
Chr. Yellow
Vermilion
Lt. Green
Dark Red
Lt. Blue
Maroon
Orange
Yellow
Purple
Brown
Mauve
Violet
Ochre
White
Green
Black
Sepia
Grey
Pink
Blue
Red

24 COLORS

$1.00 per doz.

ASIDE FROM the excellent qualities of UNIQUE Pencils as a sketching and drafting medium, they lead to many a short cut and time-saving in an engineering office.

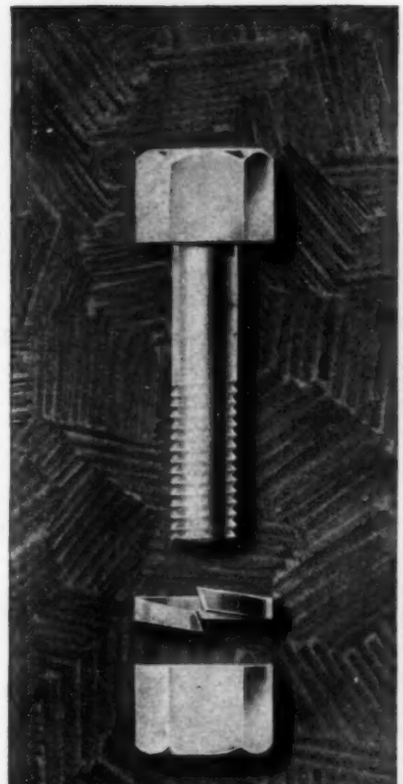
Often the UNIQUE *Blue and White* will save remaking tracings and blueprints because with these two colors corrections can quickly be made on even the most complicated blueprints.

All primary colors and shades
12 Colors (Asst. No. 1116) *per box* $1.00
24 Colors (Asst. No. 1117) " " $2.00

At all dealers or write direct

A VENUS Pencil Factory Product

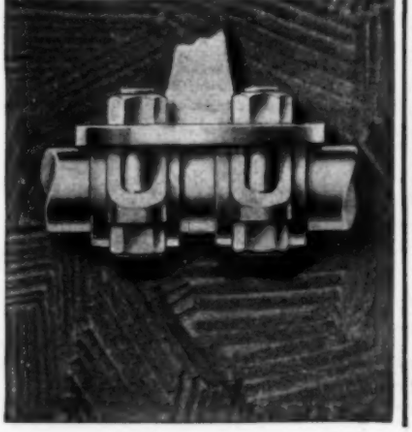
American Pencil Co., 536 Venus Bldg., Hoboken, N.J.



ANACONDA
from mine to consumer

There is usually one best metal for every requirement.

The American Brass Company, through its Technical Department, is prepared to help determine what this metal is and if the need can be met most advantageously with copper or an alloy of copper, to supply the metal in uniform, dependable quality.



REG. U. S. PAT. OFF.

EVERDUR

(A Copper-Silicon-Manganese Alloy)

Everdur Bolts Possess High Strength, High Fatigue Limit, Remarkable Resistance to Corrosion

THE demand for bolts having the strength of steel and high resistance to corrosion has been met with Everdur, an Anaconda alloy of copper, silicon and manganese. Everdur possesses high fatigue limit, toughness, resistance to shock, and ductility that provides a wide margin of safety even when stressed beyond the elastic limit.

Everdur bolts in the usual diameters have a tensile strength of 90,000 pounds per sq. in. Hard drawn Everdur has a fatigue limit at 200,000,000 cycles approaching 30,000 lbs. per sq. in. ⅜ inch Everdur bolt rods exposed to the elements and stressed beyond their elastic limit for 31 months were strained to 1% extension during the first month, to 2% in the next six months, and to 4% for two years with no indication of failure.

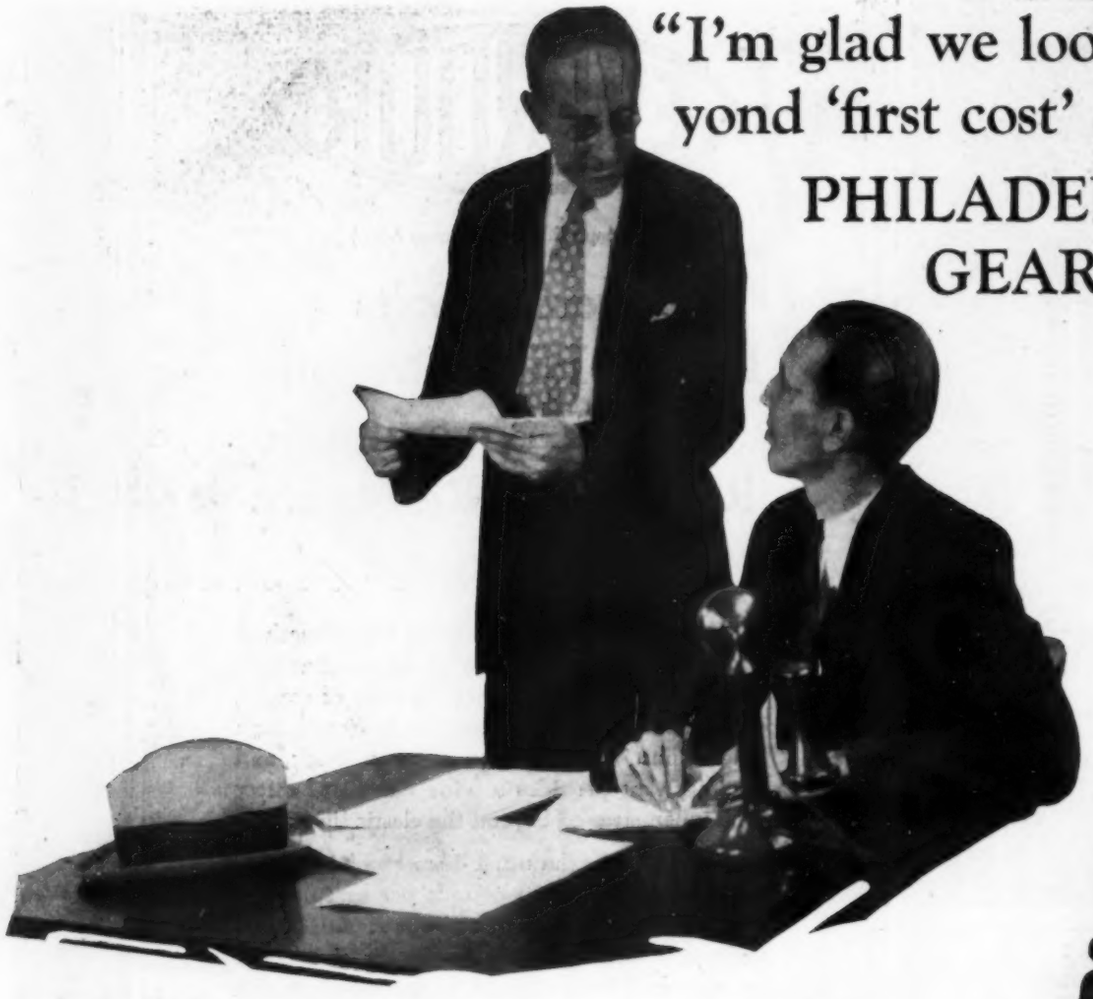
The same qualities revealed in Everdur bolts recommend the use of this metal for lag and wood screws, washers, nails, rivets, pressed parts, castings, drop forgings, etc. Obtainable in these and other forms from leading fabricators, Everdur is furnished by The American Brass Company in sheet, rod, wire, tube, blank, rivet and ingot form.

For further information, Anaconda Publication E-2, Fourth Edition, will be gladly forwarded upon request.

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Offices and Agencies in all the Principal Cities
Canadian Mill: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ontario

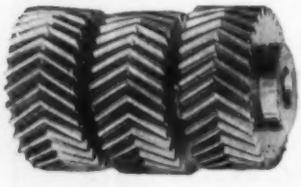
ANACONDA
COPPER ANACONDA BRASS

"I'm glad we looked beyond 'first cost' and got PHILADELPHIA GEARS"



That's the whole story! It's not because we've been making gears 50 years. It's because TODAY Philadelphia Gears can be guaranteed on 2 counts. First—Philadelphia Gears are 100% inspected during manufacture—no rejects. Second—modern facilities may clip days or weeks off our production delivery promises—in your favor. You will be amazed at the time schedules we can meet on quantity production on a *quality* basis. Look beyond cost arguments to Philadelphia DEPENDABILITY—write for Catalog.

P.S. Of course you'll come to us for hurry-up service on that bound-to-happen gear breakdown in your plant. We never failed a customer!



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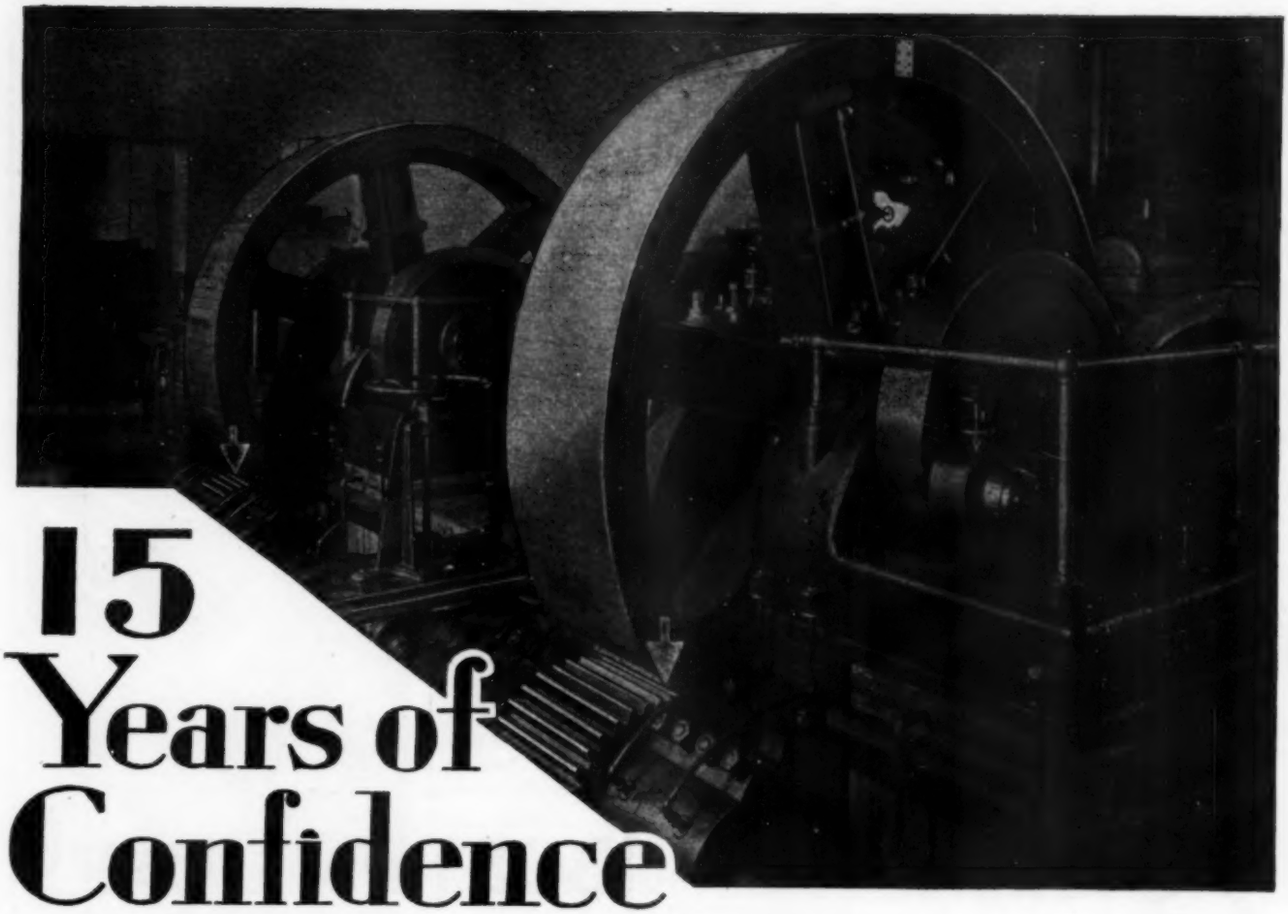

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Horsburgh & Scott Co., Cleveland, Ohio
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The Fabroil pinions used have averaged seven years life—and one pinion ran for nine years.

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HIGH SPEED GROUND THREAD WORMS

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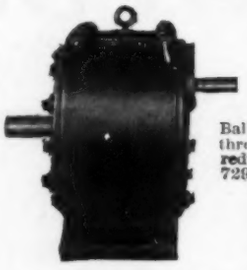

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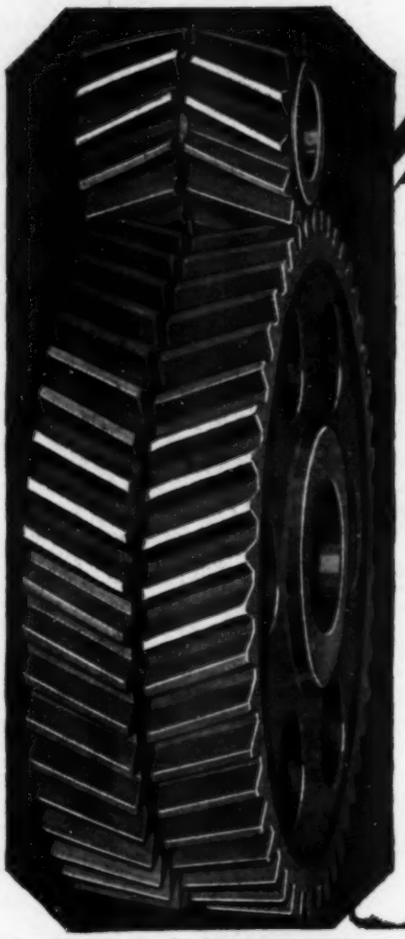

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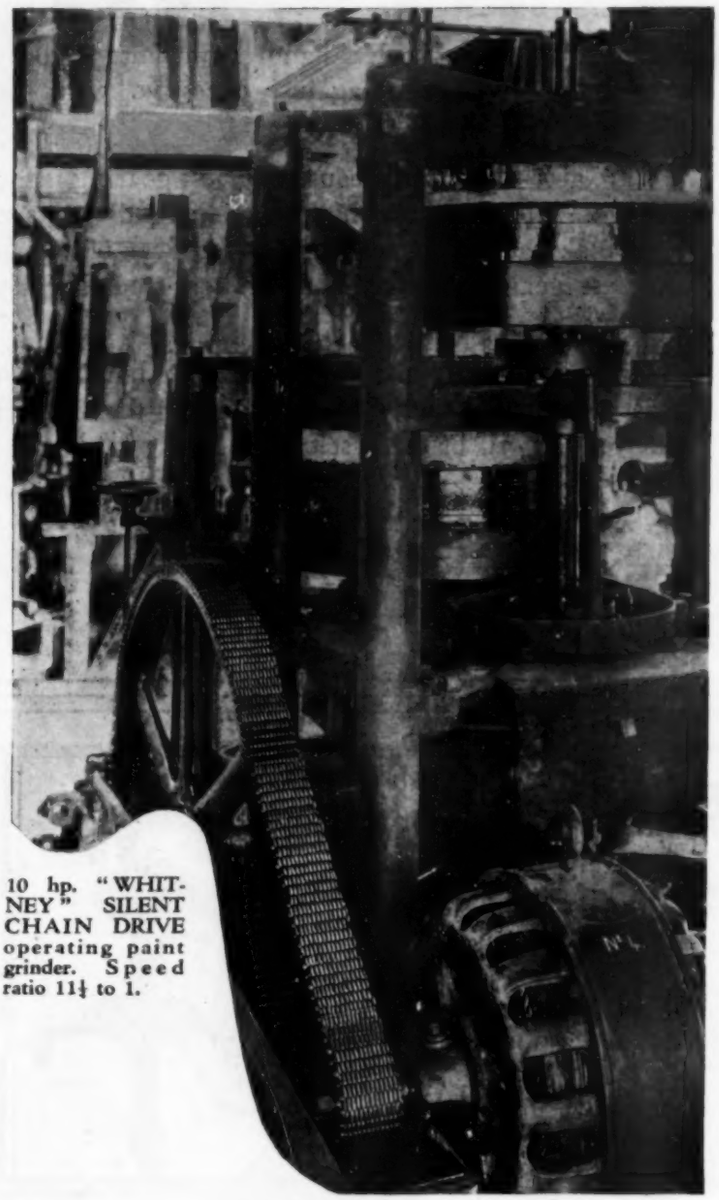

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Made in various Sizes and Types to meet all needs.
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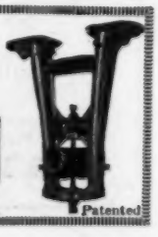

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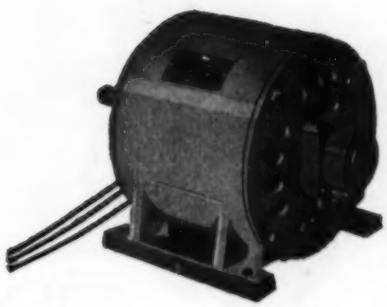

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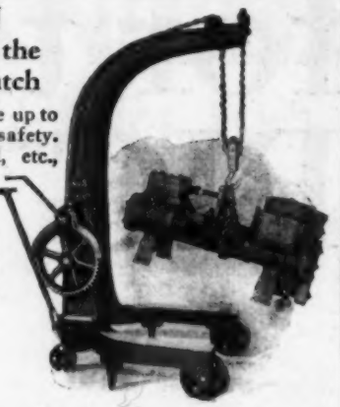

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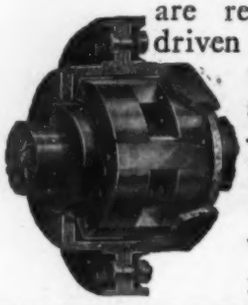

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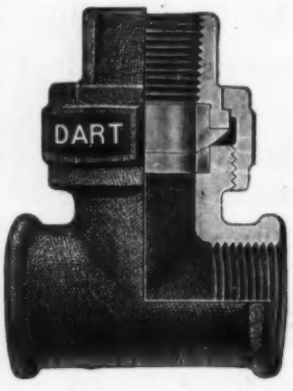

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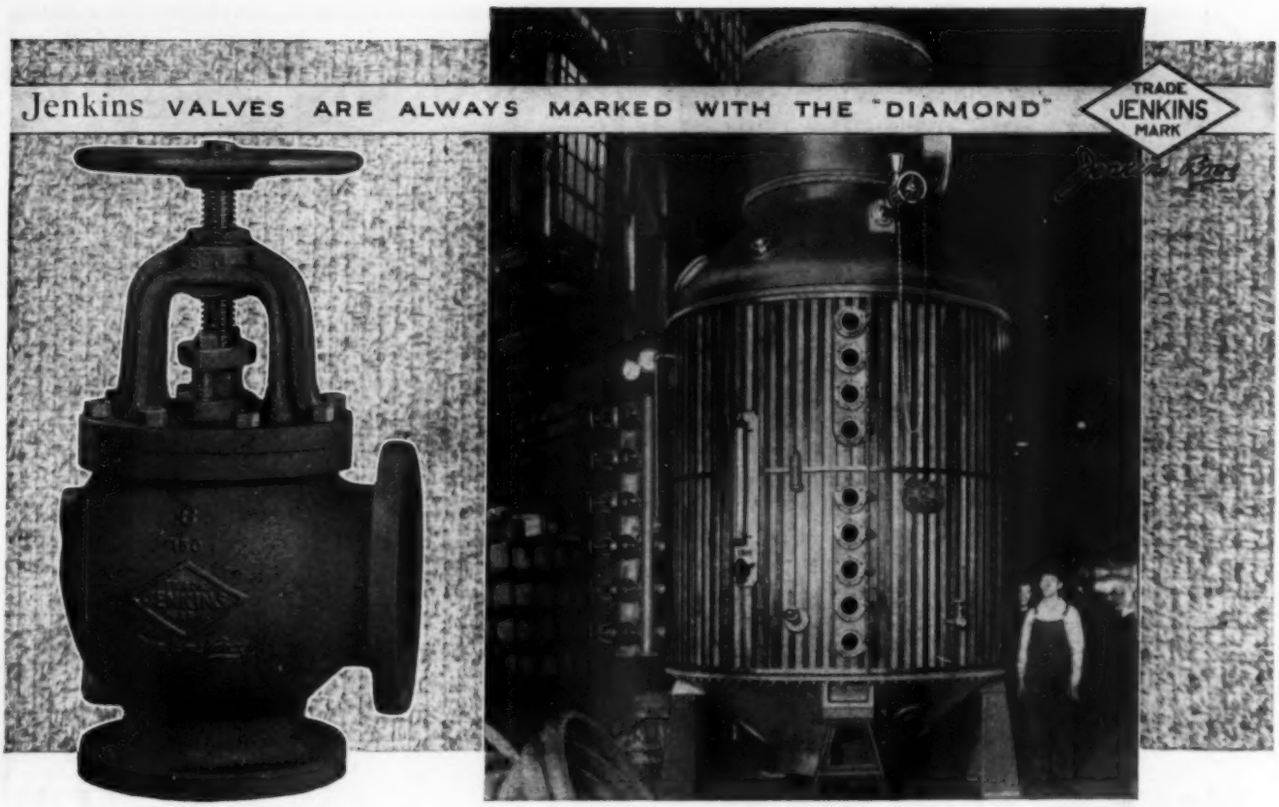

Left: Jenkins Fig. 144 Standard Iron Body Angle Valve, flanged. Above: Jenkins Fig. 144 Valves, on sugar house vacuum pan, manufactured by the Geo. L. Squier Mfg. Co., Buffalo, N. Y.

Where processes call for close control —Jenkins Valves are a *safe* selection

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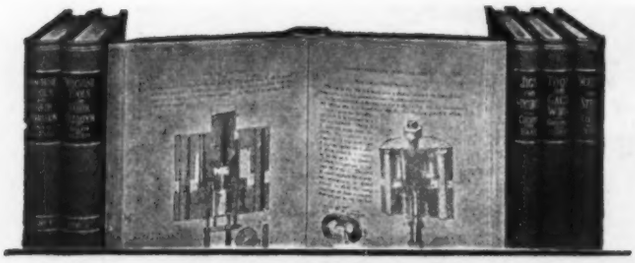

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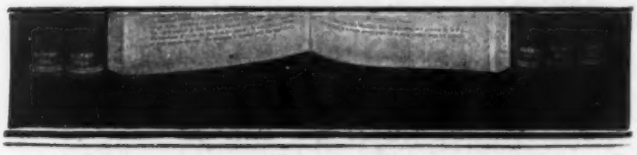

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We manufacture highly efficient equipment to economically perform the above kinds of welding. Consult our Sales Engineers at the nearest office.

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If we haven't a standard machine exactly suited to your requirements, WE WILL DESIGN AND BUILD ONE FOR YOU. Can we say more?

The Federal Machine & Welder Co.
Branches in twelve cities. Warren, Ohio

Spot— Butt— Seam— Welders

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Manufacturers of

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Hand and Automatic

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Introducing a new Acetylene Generator

THE new Prest-O-Weld Medium Pressure Acetylene Generator is portable—light enough to be moved from place to place easily—rugged enough to withstand rough handling. There is no maintenance or upkeep expense. Welded construction and heavy gauge material have been used throughout.

This generator combines all the best features of medium pressure type apparatus. It can be used with any make or style of oxy-acetylene blowpipe. It is compact—simple to operate—and has unusual safety features. It has been tested and is listed as standard by the Underwriters Laboratories, Inc. It takes a charge of 30 pounds of $^1/_4$" x $^1/_{12}$" carbide and has a rated generating capacity of 60 cubic feet of acetylene per hour.

This generator is available through Prest-O-Weld jobbers throughout the country.

PRICE $185.00

(slightly higher at Denver and west)

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Unit of Union Carbide and Carbon Corporation

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PREST-O-WELD

Technical Publicity Department,
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205 East 42nd Street, New York, N.Y.

Without obligation, I would like further information regarding the new Prest-O-Weld generator.

Name .....

Street .....

City ..... *State* .....

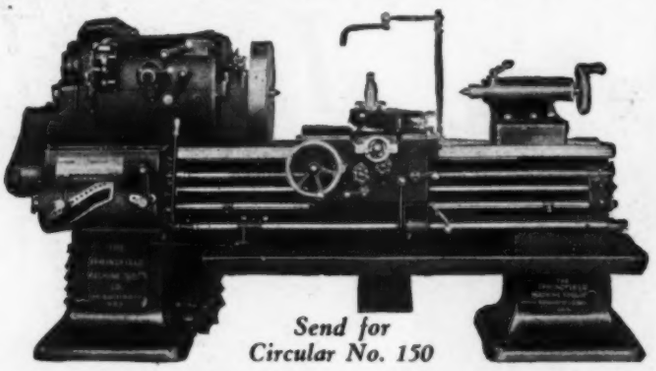
My Jobber's Name .....

SPRINGFIELD BALL BEARING GEARED HEAD LATHES

For the tool room

This new model, shown with motor drive in leg, carries the name "Springfield" to even higher levels.

It makes possible greater accuracy without added care. Set up time is cut to a new low mark.



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For production

They are staunch enough to be profitable, and fast enough to prove superior on all production work.

Users know that, "only Springfield can equal Springfield performance."

The Springfield Machine Tool Co.
Springfield, Ohio

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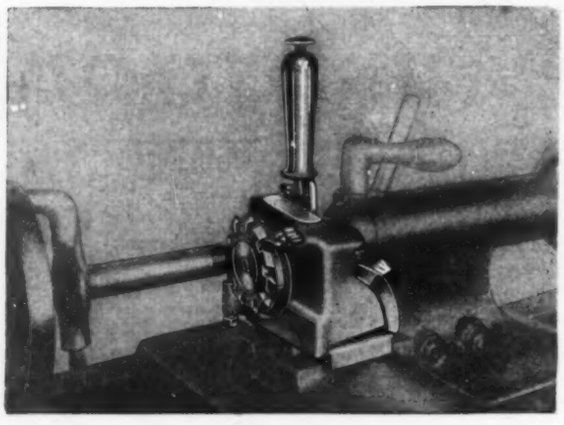

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THE most rapid and accurate thread tool on the market ten-tooth cutters (made for all forms of thread except the square and in pitches six and finer). The thread is generated in ten progressive cuts. The thread tool automatically indexes the cutter. Used in greater and greater numbers by many leading manufacturers throughout the world. Send for Bulletin 110-A.

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BRIGHTON DISTRICT, BOSTON, MASS.

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A Guarantee of Satisfaction

Built of finer materials and inspected to higher standards than ever before, they may be depended upon for reliable and superaccurate service.

Six sizes available — motor or countershaft driven.

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Established 1862 **Waltham, Mass.**
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This precision bench lathe handles light and medium jobs of turning, drilling, screw cutting, milling, etc. It's a versatile unit that will cut production costs because it is never idle.

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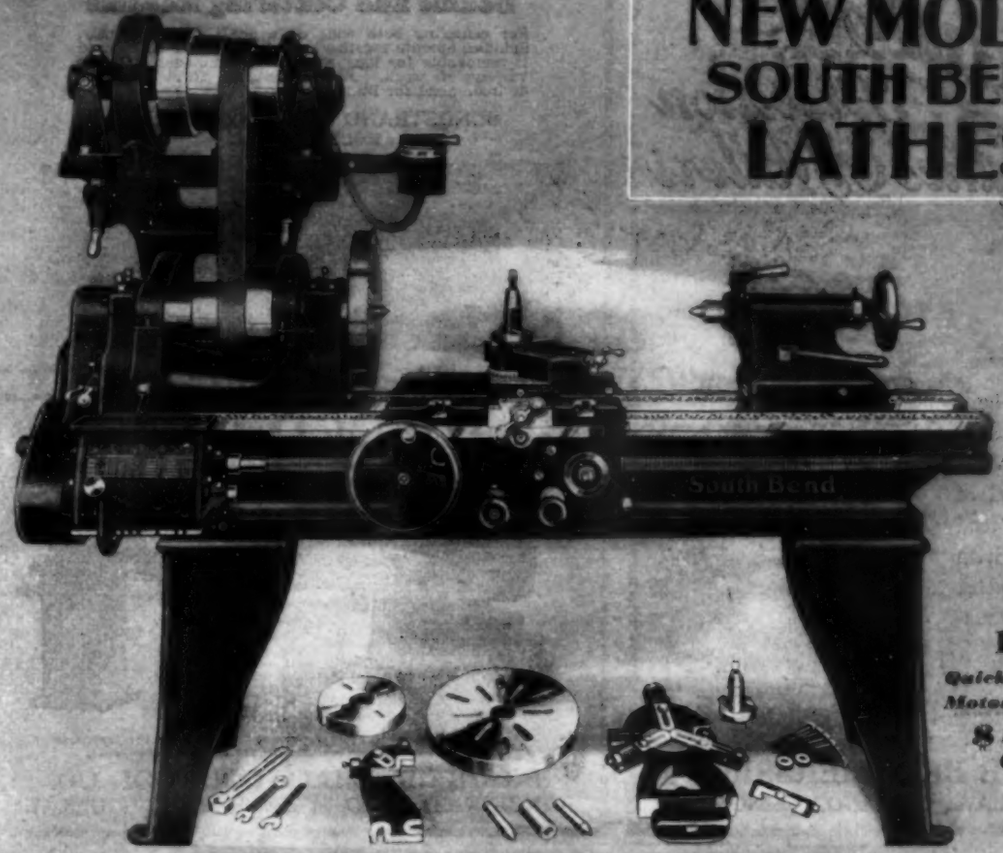
NEW MODEL SOUTH BEND LATHES



16″ x 6′
Quick Change Gear Motor Driven Lathe
$777

Reversing motor, reversing switch and lathe equipment included in price of lathe

South Bend New Model Lathes are built in 96 sizes and types from 9″ swing to 18″ swing inclusive, with 3′ to 12′ bed lengths in various patterns listed below:

Countershaft Driven Lathes
Motor Driven Lathes
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Gap Bed Lathes
Brake Drum Lathes
Bench Lathes

Write for new Catalog No. 90-A, illustrating, describing and pricing the complete line of New Model South Bend Lathes. A copy will be mailed free on request.

The South Bend Lathe Works is represented by prominent machinery dealers and importers in the leading cities of the world. Most representatives carry South Bend Lathes in stock where they may be seen and examined.

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For Manufacturing, Production and the Tool Room

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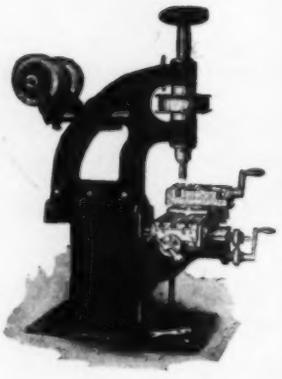
Established 1906 Lathe Builders for 23 years

44,000 Lathes in use in the U. S. and 78 other countries

Plant of the South Bend Lathe Works

Cataract Precision Lathes & Millers

Cataract Vertical Miller



If it's a milling job of high precision, it's a Cataract Miller Job. Table feed is automatic, with travel of 5½ inches. All feed screws are provided with independent micrometer steel indexes with graduations of .001.

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Double End Centering Machine

For centering both ends of a shaft simultaneously. Spindles operate together or independently. L. H. head is removable for long shafts. Accommodates a wide variety of work. Special fixtures furnishes when desired. Send for Bulletin.

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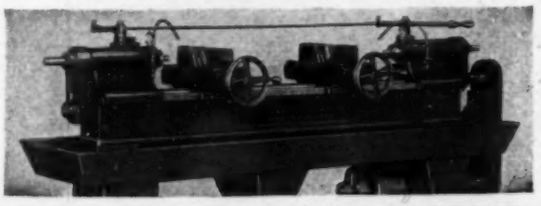
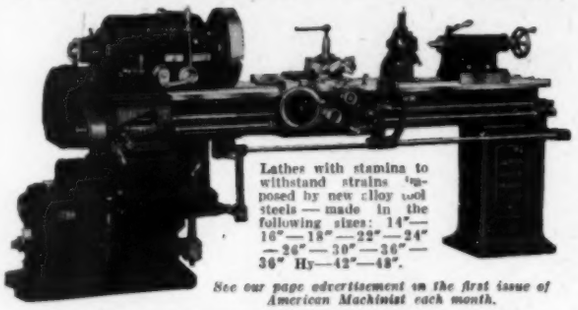


BRADFORD LATHES



Lathes with stamina to withstand strains imposed by new alloy tool steels — made in the following sizes: 14"—16"—18"—22"—24"—26"—30"—36"—36" Hy—42"—48".

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CINCINNATI, OHIO *Established 1840* U. S. A.

FLATHER LATHES

The design incorporates the most advanced principles of modern machine tool practice—backed by over fifty years' experience as specialists in this field.

Sizes from 14-in. to 26-in.

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THE LATHE WITH A LONGER LIFE
Built in Sizes from 14-in. to 36-in.
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Manufacturers of Grinders, Buffers, Speed Lathes and Manual Training Lathes.
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Full Swing Side Carriage, Heavy Duty Type Machines, covering Bar Work from 2 in. to 12 in. and Chucking Work up to 32 in. in diameter. Dealers in all principal cities.

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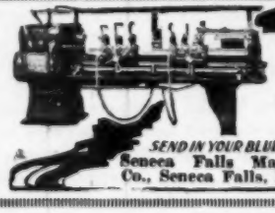

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is what you secure by turning your shafts by the
Lo-swing METHOD

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Seneca Falls Machine Co., Seneca Falls, N. Y.

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Heavy Duty Plate and Structural Tools, Heavy Duty Engine Lathes, Special Production Lathes and Crankshaft Turning Equipment. Blue Print Machines

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WESTCOTT CHUCKS
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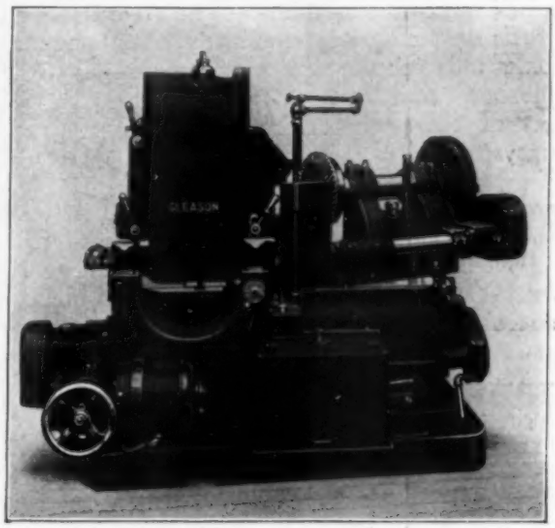
ONE CUTTER NOW DOES THE WORK



With the angular adjustments on the cutter spindle of the new 15-in. Spiral Bevel Gear Generator, one cutter can be used for cutting a variety of gears within the capacity of the machine providing they are of the same pressure angle and are cut with the same diameter of cutter.

As over 90% of the Spiral Bevel Gears in use today have a pressure angle of 14½°, one roughing and one finishing cutter of each diameter; 6 in., 9 in., and 12 in. and a supply of shims is all that is necessary to cut nearly any gear within the range of the machine.

Full information on the machine is available and production times will be given on receipt of blueprints.

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Manufacturers of Bevel Gear Machinery for Over Sixty Years

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Up to 32-in. O.D. cut Theoretically correct. SPECIAL facilities for CUTTING, in any MATERIAL. SPUR, MITRE, WORM, HELICAL, INTERNAL, ELLIPTICAL GEAR WHEELS, SKEW (Hypoid) BEVEL GEARS.

Let the *originators* of *Spiraloid* and *Skew (Hypoid)* GEARS with offset AXES solve your GEAR PROBLEMS

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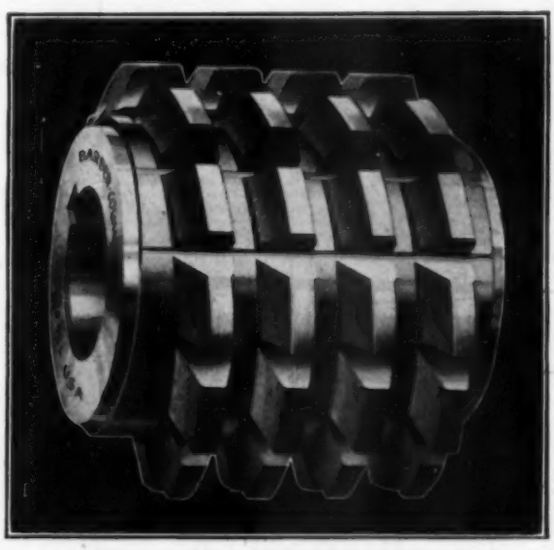

Gear Hobs

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CLARITE HIGH SPEED STEEL
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It pays to use Good Tool Steel.

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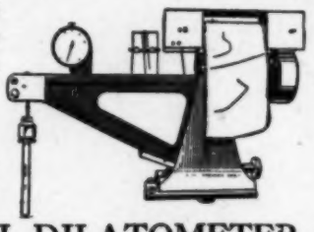

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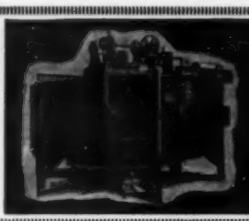

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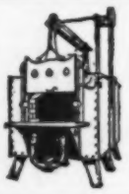

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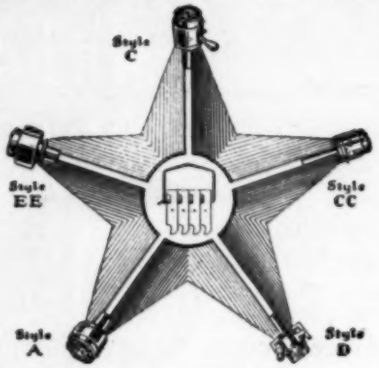

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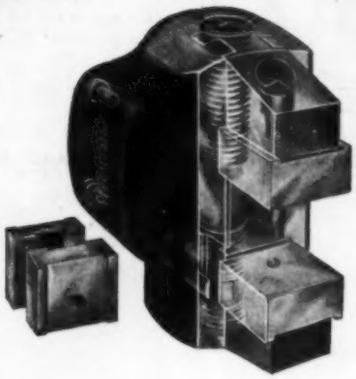

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With Incomparable *Features*

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We build Chucks for Lathes of every description

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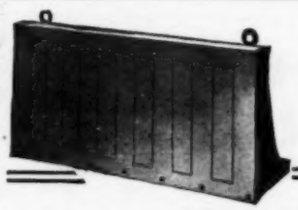

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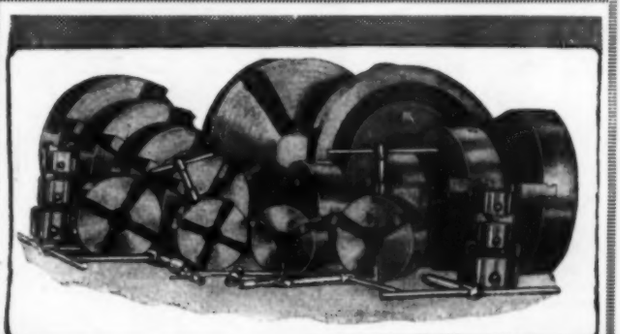

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For regular work. Iron bodies—three or four jaw types. Rigid—accurate chucks meet all the ordinary requirements of machine shop work.

Whiton chucks have always been a high quality product. Long satisfactory service are assured by their design and workmanship.

Whatever your requirement there's a Whiton Chuck for it. ***Send for Price and Dimension list.***

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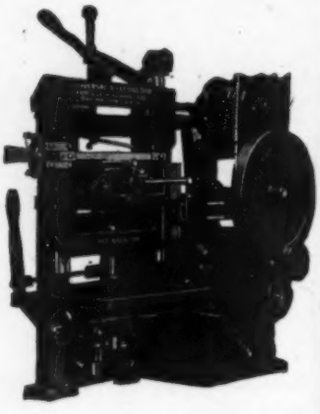

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If you are looking for long-lasting, keen edges—for blades that cost less because they cut more, just ask for "The Tools in the Plaid Box"

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For Close Accuracy, and Large Production

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The Shear Cut for Production Work.
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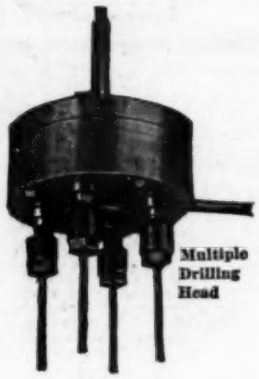
Errington Multiple-Spindle Heads

For Tapping, Drilling, Hollow-Milling, Reaming, Threading, etc. on Single Spindle Drill Press



Multiple Drilling Head

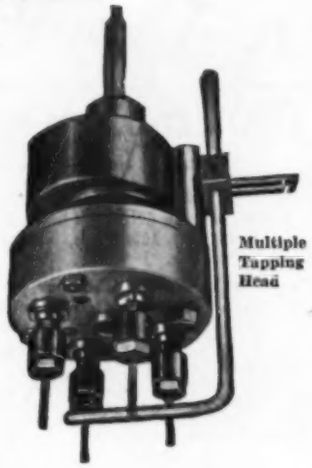
Cuts cost of small parts; work self-holding; finishes all holes at cost of one. Universal joint. "Floating" Tap-holders make it possible to tap holes in parts having distorted surfaces, without breaking taps, such as steel stampings, etc.

ERRINGTON

Patented

Super-Sensitive *Close-Center*

MULTIPLE-HEADS



Multiple Tapping Head

Submit all details of your work to our Engineering Department, which has enjoyed 35 years of world-wide experience in Tapping, Screw-cutting, Stud, Nut and Screw-driving operations for the largest specialty manufacturers. Our great variety of styles and sizes enable us to select the ***Simplest Outfit to Produce Results*** that will astonish you in Uniform, Low-cost Production. It is your move; write for catalog NOW ! ! !

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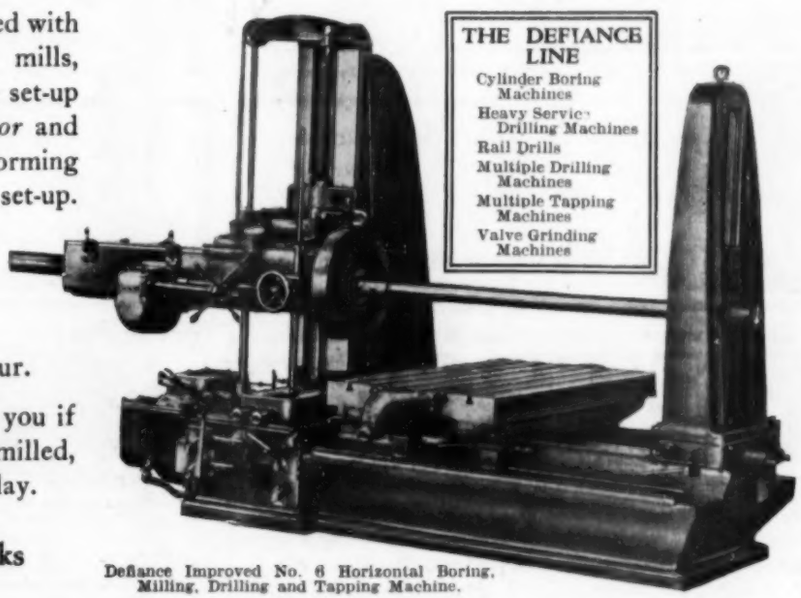
Big Savings with this 4 in 1 Defiance Horizontal!

This versatile machine, equipped with a revolving indexing table, mills, drills, taps and bores with one set-up of the work. It's a *time, labor* and *space saver. Time*—by performing four operations with a single set-up. *Labor*—by eliminating unnecessary shifting of parts from machine to machine. *Space*—by having only one machine to do the work of four.

These savings mean profits to you if your product requires drilled, milled, bored or tapped parts. Act today.

Defiance Machine Works
Defiance, Ohio
Since 1850



Defiance Improved No. 6 Horizontal Boring, Milling, Drilling and Tapping Machine.

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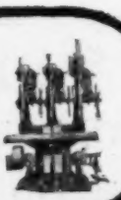

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Saves time—Speeds Operation

This is but one of many desirable features of the New Thompson Super-Drilling Machines, Bench Type.

The Wonder Pulley Chamber provides many instant speed changes while machine is running. There's no belt to change no adjustments to make.

Thompson Super-Drilling Machines, Bench Type, require no costly overhead pulleys on shafting. Simply plug in to nearest lamp socket.

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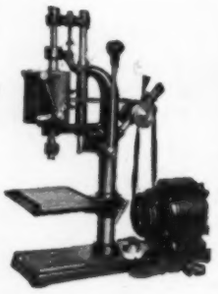

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The SWISS JIG BORER

Rapid—Exact —Satisfying on all Precision Work

Write for our latest circular "Features Which Distinguish Swiss Jig Borers." It includes specifications of the two latest models.

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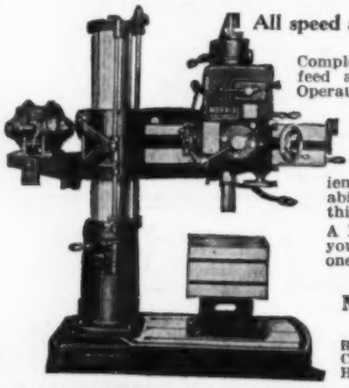
All speed and feed changes in head



Complete operating control, both feed and speed, is in the head. Operator easily reaches all levers from normal working position.

Changes are made through sliding gears running on fixed centers. Convenience in operation and dependability of service result from this compact design.

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Their "minute-saving" features of design will greatly increase your drilling output and profits. Get the complete details from our branches in the principal cities.

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Standardize on FOOTBURT *Drilling Boring, Tapping Machines*
FOR PRODUCTION!

Leading manufacturers of Single and Multiple Spindle Drilling Machines, Cylinder Boring Machines, etc., and various types of special equipment.

THE FOOTE-BURT CO.
Cleveland, Ohio

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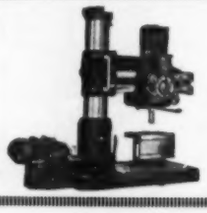

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The Carlton All Ball Bearing Radial Drill pleases its users. Has done so for FIVE YEARS and will continue to do so. Learn all its features and you'll see why.

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Production Drilling Machinery

Established 1872

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"If it's to be drilled, drill it the 'SUPERIOR' way"

BIG BUSINESS!

What a rude awakening it is for all of us to find that it is again time for *inventory* after a year of record BIG BUSINESS.

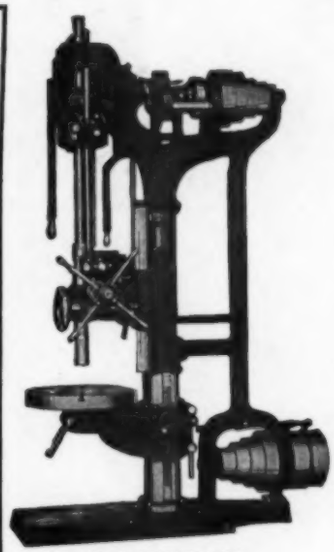
Drilling departments are one place where those dreaded RED figures make their appearance when least expected. All due to one, two, or more machines that cannot "produce." Consequently the returns of the whole department are held "in the RED."

"Superior Drilling Service" will overcome that obstacle quickly and thoroughly.

Yes, that Service is furnished with either our SUPERIOR STATIONARY or SLIDING HEAD Drilling and Tapping Machines, at no extra cost.

Before installing additional Drilling equipment, consult our competent staff of engineers and allow them to assist you with your

modern production drilling problems.



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are best for general purpose production on small hole drilling jobs. The work is clamped automatically and can be burred automatically if desired. The spindle is advanced under a resilient pressure feed with friction control which varies the rate of penetration automatically to meet the variable conditions encountered as though under human control. The result is an extra high drilling speed with a big saving in drill breakage.

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Drilling an even dozen

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This particular head drills 12 holes at a time. But we make any type to suit any particular need.

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DRILLING REAMING TAPPING HONING

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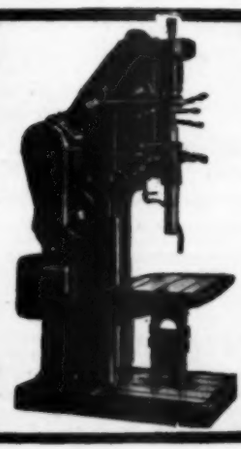

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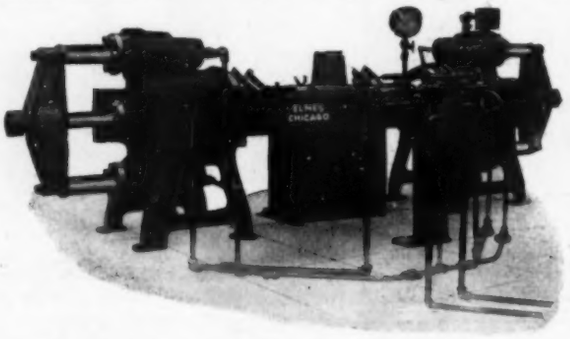
PRESSES PUMPS ACCUMULATORS
SINCE 1851

Insure Maximum Production

Our Hydraulic Extrusion Presses are built to withstand the highest extruding speeds which various lead and solder compounds will endure.

Our latest extrusion equipment for lead pipe and solder or lead traps and bends is featured by simplicity of valve control. A single hand wheel controls both forward and reverse movements of the ram. Return ram movements are effected by independent cylinders.



Lead Trap Press requiring but 2 Extrusion Cylinders up to 4-in. Traps and Bends

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SWAGING MACHINE —with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Modern Art of Swaging."

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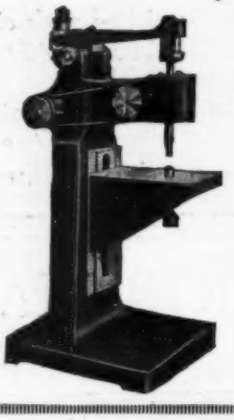

Just the thing for small riveting

This rotating vibratory riveter is a light bench model that will speed up your production on small riveting up to ⅛ in. diameter. Easily operated by an apprentice or the most inexperienced female labor.

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Riveters

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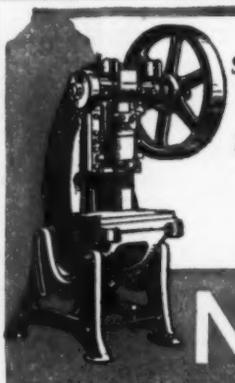

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Inclinable, Horning, Straight Side, Punching, Gap, Knuckle Joint and Screw Presses

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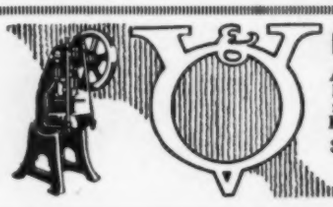

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A complete range of Punch Presses, including dial, magazine, roll feeds, and King Pressure Toggles.

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Before making purchase of any kind of hydraulic equipment, it will pay you to see what we have to offer.
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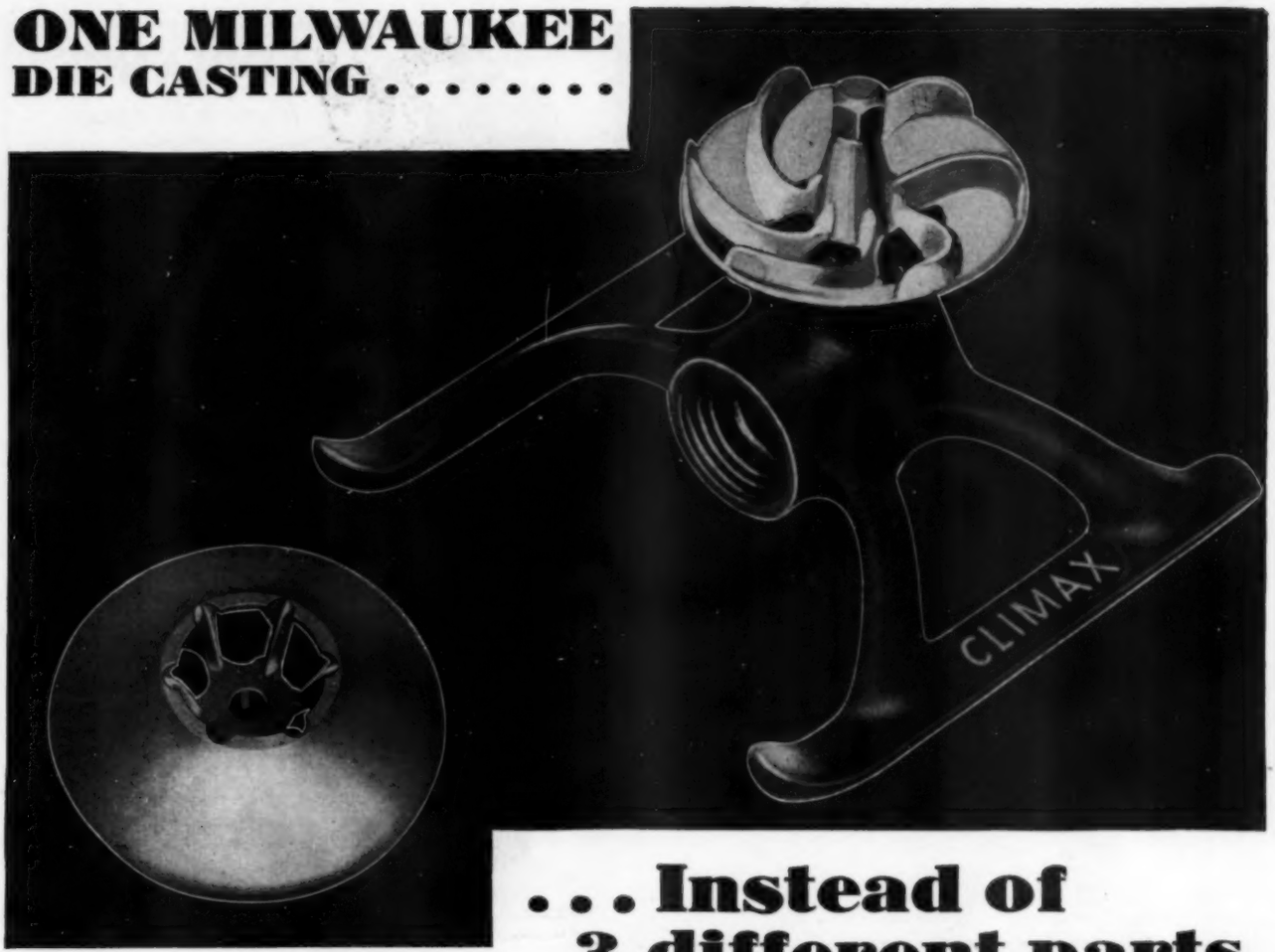
World's largest manufacturers of Bus and Truck Frames. Specializing in the design and development of heavy pressed steel parts.

ONE MILWAUKEE DIE CASTING . . . . . .



The top illustration shows the Climax Sprinkler, and presents a clear view of the top surface of the die-cast rotary.

The lower illustration presents the bottom view of the die-cast rotary alone.

. . . Instead of 3 different parts

Smoother—No Machining

THE Climax Lawn Sprinkler, made by the Hamilton Metal Products Co. of Hamilton, O., provides the theme for another story of improved design, better performance, fewer parts, simplified production and lower costs through the use of a Milwaukee Die Casting.

By substituting an aluminum die cast rotary for a sand casting, the need for a brass bushing and copper washer was entirely eliminated. So was the machine and hand labor formerly required to put the three parts together.

The die cast rotary is delivered complete, ready for assembly. Its smooth, cone-shaped lower surface requires no buffing or polishing. Its light weight makes it much easier running than the type formerly used.

Die casting this part, and one other improvement, has enabled the manufacturers to increase production, reduce overhead and offer a lawn sprinkler that is extremely simple in design and operation.

This simply written, clearly illustrated booklet tells you about the die casting process, its possibilities and limitations. Send for your copy, today.

Why not find out whether or not die casting can improve your product or simplify your production problems. Your inquiry does not obligate you in any way.

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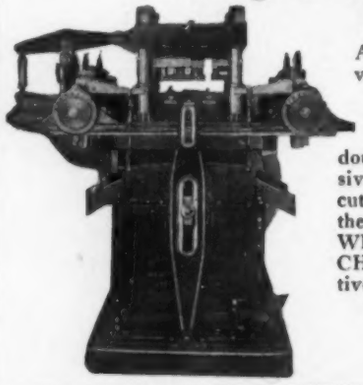
DIE CASTINGS AND BEARINGS

Investigate this new type of Punch Press!



Automatic feed of a universal type, sustained high rate much faster than hand feed, low, rigid construction that doubles the life of expensive Dies, and better, clean-cut stampings are a few of the advantages of the WRIGHT DIEING MACHINE. Write for descriptive catalog.

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"ADRIANCE"
Punch Presses

Sturdy tie-rod construction assures long life for press and tools, with expedition and accuracy of performance in punching, bending, forming and perforating operations.

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ONE OF OUR MANY STYLES AND SIZES

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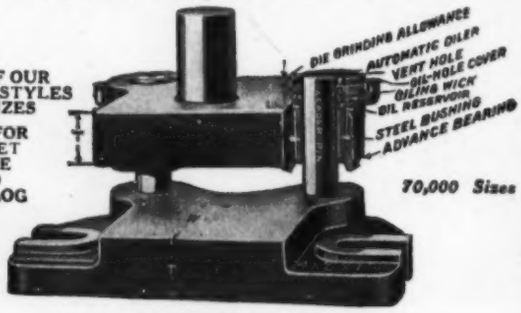

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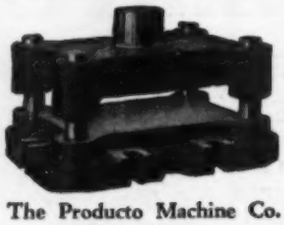

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No stamping too difficult!

This subject is shown as an example of how simple a job we make of Special Metal Stampings to your order —even if they are intricate. Our 40 years' experience, complete equipment and moderate overhead all work to your advantage.

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Leader pin bosses are outside the working surface and bearing lugs clear die block permitting use of full capacity on U. S. Tool Die Sets. You'll see the difference.

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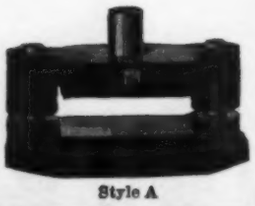

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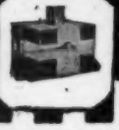
Die Makers Supplies
Complete Stocks All Warehouses



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Send Blueprints for Estimates

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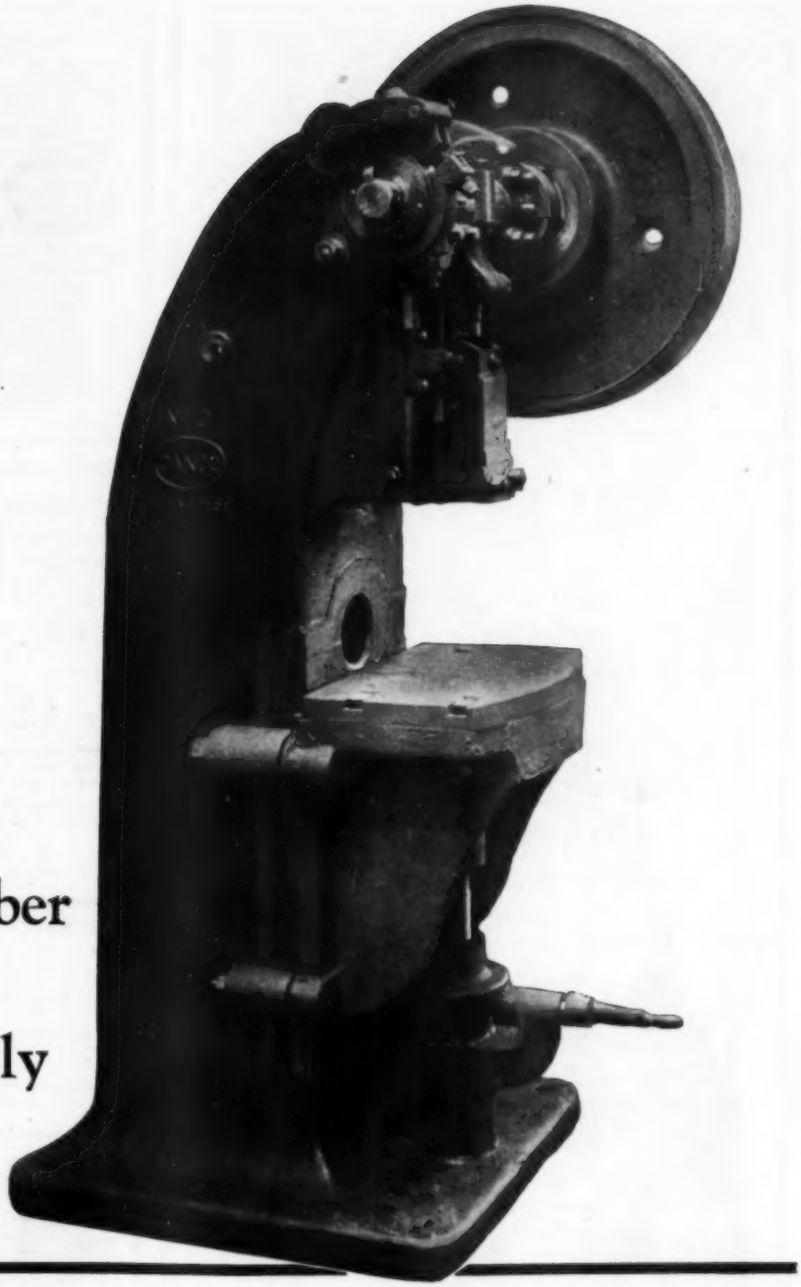

An equally fine member of a well known family

HERE are some of the features that make Canco Horn and Apron presses models of efficiency—of smooth operation and rugged power. Features that win manufacturers' everlasting praise wherever there's need for precise and exacting work.

The famous 6 point double pawl clutch is a safe and willing aid to increased production. The cam actuated brake is a positive power saver. And a sturdy apron with simple yet rugged apron clamps and an efficient elevating device, makes tedious adjustments an annoyance never to return.

Accurate in alignment, Canco presses are a happy combination of fine design and massive construction. They're built for the manufacturer who measures a press by its efficiency —its accuracy and power.

CANCO

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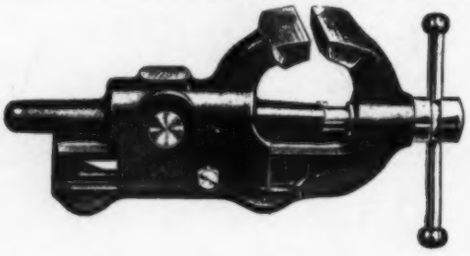
EQUIPMENT DIVISION

NEW YORK - CHICAGO - CINCINNATI - SAN FRANCISCO



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Drop-Forged throughout—no castings—this vise is new in principle. The rear jaw moves along a machined guideway—the jaws are always parallel at any opening—never loose.

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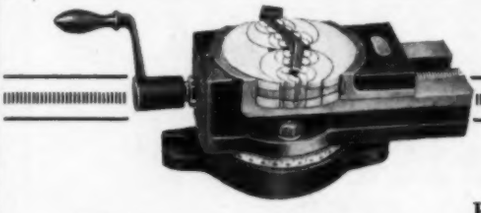

Unique in Design

Self-aligning jaws of the Boston Universal Vise securely hold round, square and odd-shaped parts.

Operates like ordinary vise, yet it is practically several work-holding fixtures in one.

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U. S. Automatic Box Machinery Co.

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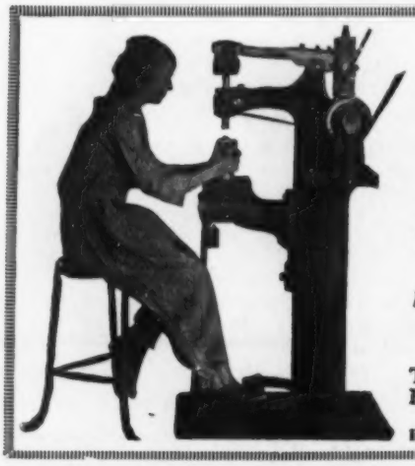

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Cold Riveting 1/64 in. to 1¼ in. in diameter

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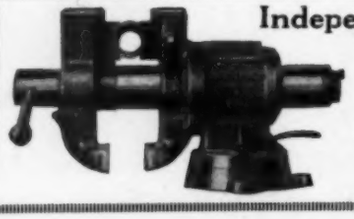

Independent Pipe Jaws

The Repair Man has more use for pipe jaws than for machinists jaws. In the NuTYP Vise the two sets of jaws are independent. Either set is immediately available.

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Oswego, N. Y.

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Littell's Automatic Feeds will Triple Production of hand-fed punch presses on many operations, and increase the output on some ten-fold. They can be used on all makes of punch presses. Write for full particulars.

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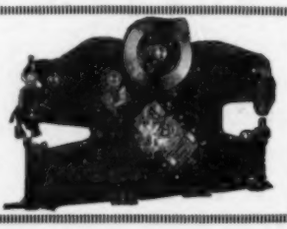
"Buffalo" Shears Punches Bar Cutters



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THE NATIONAL MACHINERY CO.

TIFFIN THE NATIONAL MACHINERY CO. TIFFIN, OHIO, U.S.A. OHIO

ORIGINATORS OF MODERN BOLT, NUT AND FORGING MACHINERY

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UNBREAKABLE STEEL PLATE FRAMES

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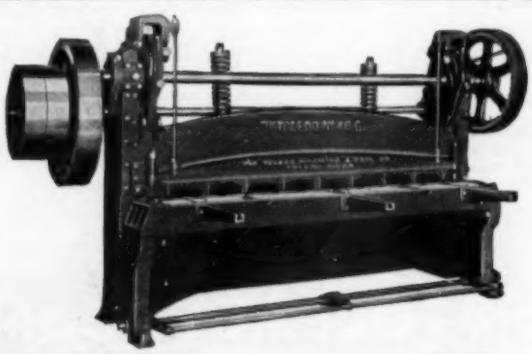
Insure Cleanly-Cut Stampings

Waltham Sub-Press Dies with positive alignment at all times, permit the closest fit between punch and die—deliver the most accurate, clean-cut stampings, free from ragged edges, distortion, and ready for assembling—no fixin' up necessary, and, best of all, are free from danger of damage through careless or inexperienced operators.

We will gladly mail you complete information regarding our sub-press, compound and other types of dies.

WALTHAM MACHINE WORKS
High St., Waltham, Mass.

THE
"TOLEDO"
SQUARING AND GAP TRIMMING SHEARS



THE "TOLEDO" Squaring and Gap Trimming Shears are notable for their high accuracy and rapid production of automobile, electrical and other metal goods. They are widely used by the largest manufacturers in the tin plate industry.

The massive frame construction provides the maximum rigidity and enables the machines to utilize their full power in maintaining their rated capacity along the full length of the blades.

Write for descriptive literature.

PRESSES FOR EVERY PURPOSE
Estimates furnished—correspondence solicited

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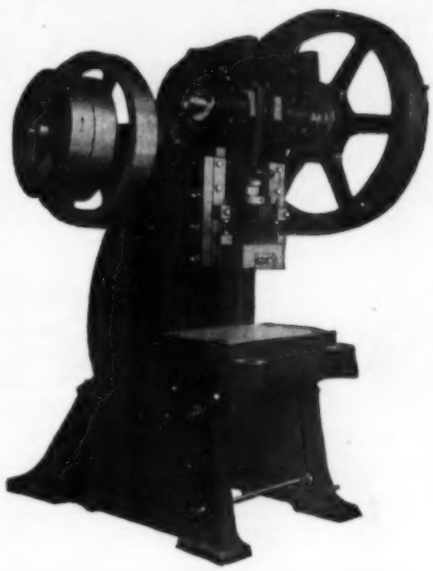
BLISS

The economy way of making sheet metal parts



Inclinable Presses

Where pierced tinware, electrical apparatus, cans, brass goods, trimmings, etc., are being made, most of the operations can be performed with greatest speed, accuracy, and economy on Bliss Inclinable Presses. This type of press is adapted for nearly every kind of blank cutting, perforating, forming, and combination die work, and is in particularly wide use because of its exceptional range of usefulness and convenience of operation.

The Bliss Inclinable Press is but one of the large Bliss line of power presses embracing a type for every sheet metal operation. Tell us what you are doing and let us give you full information on the Bliss press type best suited to your individual requirements.

SINCE
1857

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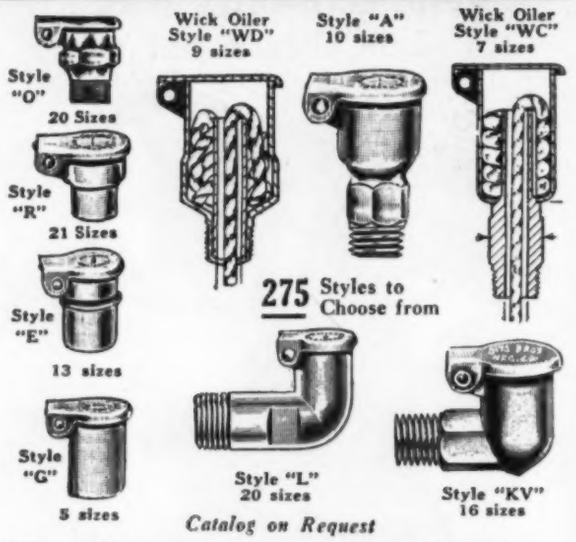
GITS BROS.

Standard of Comparison

BETTER OILERS



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will solve your cleaning problem!

Service Men Everywhere

Oakite is manufactured only by
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1% of this powerful disinfectant stops all cutting oil infections

Sylpho Nathol is powerful but harmless—one of the few germicides that are active in oil. Positively kills all bacteria that cause boils, pus-forming sores, follicle rash, and such infections.

Many prominent concerns use this germicide to prevent loss of time and interrupted production resulting from infections.

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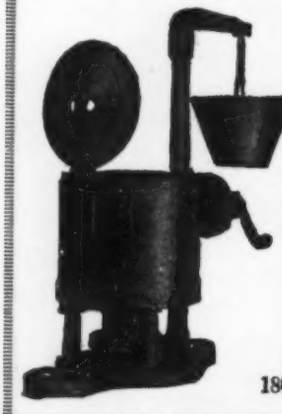
Sylpho CABOT'S Nathol



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Install a Barrett Oil Extractor and reduce cutting oil costs as much as 90 per cent.

We make a complete line of Centrifugals for extracting oil from chips and metal parts, also for washing and drying small parts. Send for Bulletins.

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Made in a variety of styles and many sizes to suit all needs. Send for descriptive catalog 10 and price list.

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Send now for all the details of "Fulflo" Pumps. If a standard "Fulflo" does not meet your requirements we are prepared to design and build special pumps.

Let us solve your pump problem.

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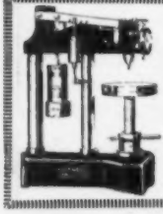
Protects metal parts or machinery against rust damage while in storage, in transit, or during export.

THE WAYNE SOAP COMPANY
Chemical Division, Detroit

COLT AUTOSAN

METAL PARTS WASHING AND DRYING MACHINES
See advertisements in the 1st and 3rd issues of the month—or write for illustrated bulletin A-15.
COLT'S PATENT FIRE ARMS MFG. CO., HARTFORD, CONN.



ROCKWELL HARDNESS TESTERS

WILSON-MAEULEN CO
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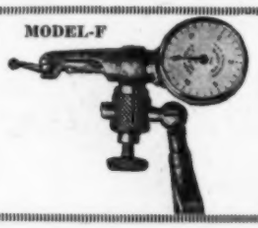
383 CONCORD AVE NEW YORK

MODEL-F



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UNIVERSAL
Test Indicators
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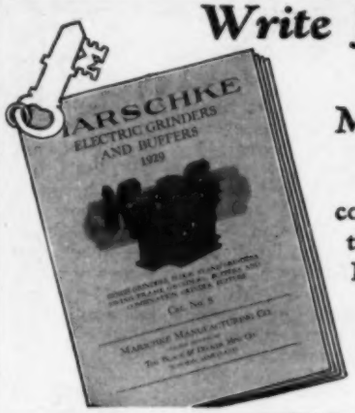
MARSCHKE CATALOG-



containing data on the complete line of Marschke Grinders and Buffers.

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Towson, Maryland
(Division of Black & Decker)

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No. 10 —High Power Type
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Blanchard Grinding Wheels
Blanchard Reaming Machines

The Blanchard Machine Co.
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DESMOND-HEX DRESSER

The Most Durable Type of Mechanical Dresser Made

In the Desmond-Hex (Huntington-type) Dresser the hexagonal, hardened-steel nuts inserted in the jaws of the Dresser have six holes, each of which, in turn, becomes the bearing for the spindle carrying the cutters. Will outwear a dozen ordinary Dressers. Made in three sizes.

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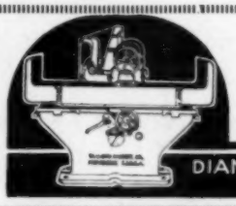

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for Increased Production with Greater Accuracy

DIAMOND MACHINE COMPANY
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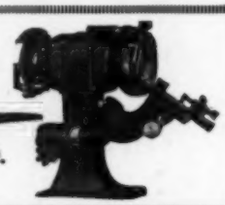
Sharp Tools Cut Costs
SEND FOR BULLETINS DESCRIBING
GRAND RAPIDS GRINDERS



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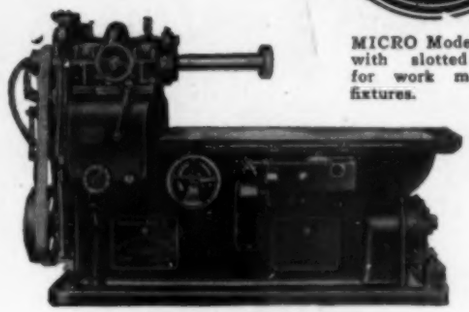
346 Straight Avenue, S. W.
GRAND RAPIDS, MICHIGAN

GRINDERS **Micro**



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RIGIDITY

The design of MICRO Internal Grinders is of such extreme rigidity as to insure long life, eliminate vibration, and give the highest degree of grinding accuracy over a long period of use.

The *base* of the MICRO is an example. It is cast intergral up to the headstock and is normalized after the roughing cut, to relieve foundry strains. Having ample wall thickness and reinforcing ribs, it will withstand the most severe strains without possibility of distortion or misalignment.

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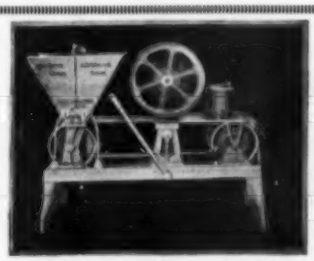
MICRO MACHINE COMPANY
Bettendorf — MANUFACTURERS AND DESIGNERS OF PRECISION GRINDERS FOR ALL PURPOSES — Iowa, U-S-A

Save Labor
Save Abrasive



Save Glue
Save Time

With This NEW POLISHING WHEEL RESURFACER

This machine developed to solve our own problems is now offered to you. A decided improvement over the old method of putting abrasive on polishing wheels. Instead of placing glue on wheels and then rolling in a trough, the abrasive is spread on face of wheels by being fed on a steel belt. No undue pressure is necessary to secure in use the full width of the wheel.

All wheels are more uniform, flat and remain accurate to original width.

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Mitchell Offers Herringbone Drive *Polishing Lathe*

Most efficient, noiseless, positive drive available. The *Herringbone Gear Drive* delivers 98% of the power to polishing wheels, and is capable of transmitting 25 horsepower.

Let us explain why this positive non-slip drive eliminates belt troubles. Write.

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Every mechanic, every tool maker, who appreciates fine measuring instruments, should own a Swedish Gage Micrometer. Of unmatched accuracy and *long life*, they are sold on a *money back guarantee.*

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MEASURING INSTRUMENTS
SWEDISH GAGE CO. OF AMERICA
406-A STORMFELTZ-LOVELEY BLDG., DETROIT, MICHIGAN

HARDNESS TESTING
Reduced to an Economic Science by Aid of
The MONOTRON

To measure hardness correctly and quickly, a pressure gauge and a technically corrected depth gauge are necessary. The MONOTRON has these, and they move in the same direction and together. These, in combination with the twin depth spacing hand, have done away with "setting to zero" and thus provide the essentials necessary for high speed and continuous application without undue fatigue to the operator. Our Bulletin M-2 and M-5 sent free upon application. It tells what the progressives in this line are doing.

THE MONOTRON

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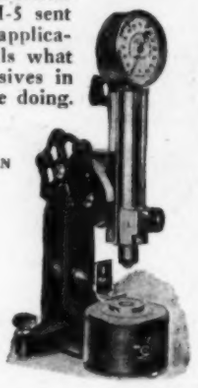

THE SCLEROSCOPE

The Shore Instrument & Mfg. Co.
Jamaica, New York, N. Y.
FOREIGN AGENTS:
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Model 30

FEDERAL
Dial Indicators
Insure Accuracy

When your inspectors use any Federal Dial Indicators, you can be sure that in addition to taking more readings in the course of a day they will maintain a higher standard of accuracy in your products. The Model 30 Dial Indicator is graduated in .0001 in.—handy and easy to manipulate.

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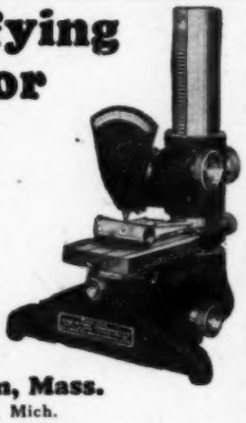
Western Branch: 7338 Woodward Ave., Detroit, Mich.

Ames Amplifying Comparator

An unusually rugged and durable gauge for testing parts in quantity with speed and accuracy



It Repeats Its Readings!
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Available in two sizes of face—2 in. and 2½ in. diam.

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Few parts, sturdy construction, easy-to-read dials, combine to make this indicator a shop favorite.

Years of gage-making experience are behind it. The gearing mechanism is cut by a new process assuring a long life of sustained precision. All working parts protected by dust covers of exclusive design (patents pending).

Available in a full range of graduations. Prompt shipment from stock.

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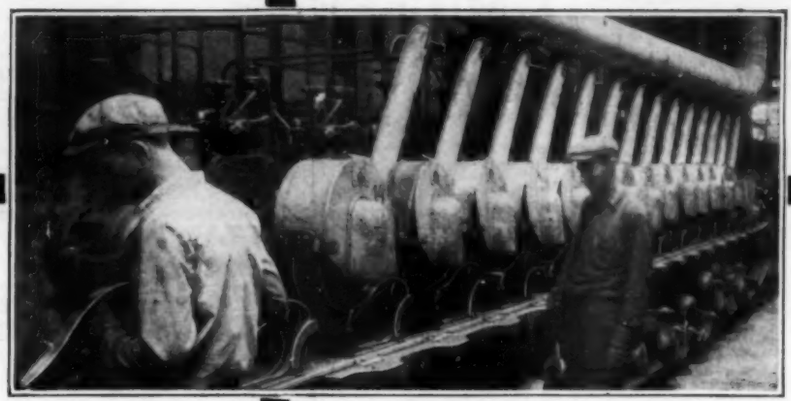
STANDARD GAGE CO., Inc., Poughkeepsie, N. Y.
DETROIT CLEVELAND CHICAGO DAYTON



Here is a grinding and polishing department that is different. It's orderly, dustless. Bumperettes as finished by this Excelsior method are sure to meet the most rigid requirements of any buyer.

Compare this Excelsior Grinding and Polishing Method with Ordinary Methods

NOW, after the installation of *seven* Excelsior Automatic Grinding and Polishing Machines, the *C. G. Spring and Bumper Co., Chicago,* is getting better finishes at lower cost.

Production rates average better than 700 parts per hour off each machine. A reduced working force turns out more pieces with less fatigue to workman. Savings in floor space and power costs are tremendous.

All of this is a result of a thorough study of the grinding and polishing problem in this plant by Excelsior Engineers working with the executives of the *C. G. Spring and Bumper Company.*

And what's more, the sales department found a better product that could be sold more easily without fear of competition.

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East St. Louis, Ill.

This is only one of the many fields in which Excelsior engineers are prepared to aid manufacturers. They are ready to tackle any problem relating to the use of other Excelsior products listed here.

1. Roller Punching Machines.
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6. Polishing Lathes and Automatic Polishing Machines.
7. Angle Iron Bending Machines.

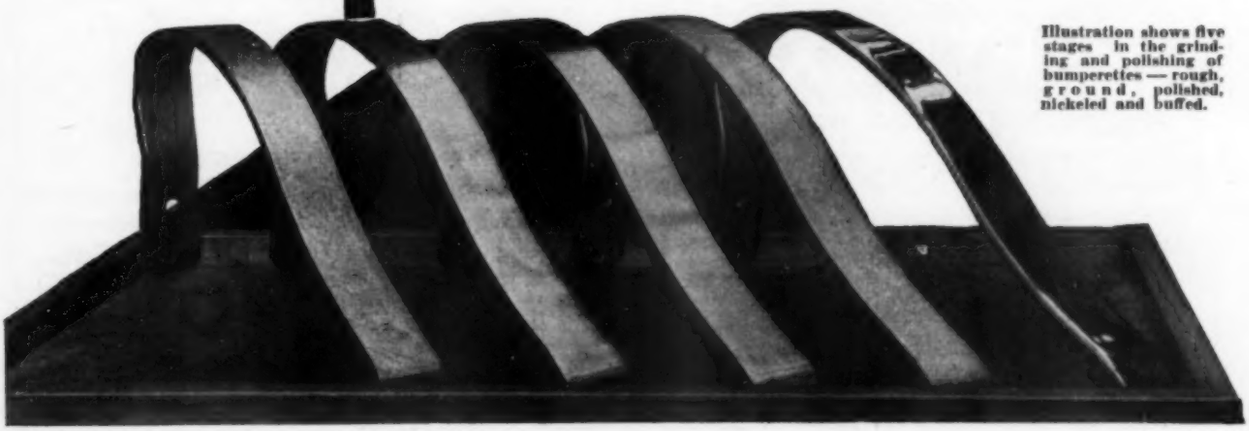

Illustration shows five stages in the grinding and polishing of bumperettes — rough, ground, polished, nickeled and buffed.

Cut Down Wheel Truing Expense. Use Dickinson Diamond Tools

They are thoroughly reliable and can be depended upon to give results.

We are proud of a long record of satisfactory service

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Successor to John Dickinson — Established 1790

BRIGG'S MILLER *for Big Production*

Get the Brigg's for heavy duty. Massive construction throughout. Fast producers of accurate work. Write for catalog and production figures.

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"BORITE" for grinding steel of all kinds.

"CARBORITE" for cast iron, bronze, etc.

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KNEE TYPE—RING WHEEL *for Flat Surfaces*

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for Emery Rings, 10 in. to 30 in.

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SHAPERS simply designed but accurate and efficient

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FITCHBURG GRINDING MACHINE CO.
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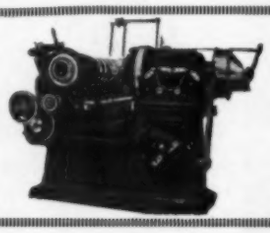

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Also Worm Grinders

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ABRASIVE SURFACE GRINDER

Either Horizontal or Vertical Spindle Type

Countershaft or Motor Drive

Get our bulletin for particulars.

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Standard Ball Bearing Grinders and Buffers

Made in sizes from ¼ hp. to 5 hp.
Drills, Center Grinder, Hand Grinders.

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Multi-Spindle CHUCKING MACHINES

GOSS & DE LEEUW

MAKE YOUR CHUCKING PRODUCTION PROFITABLE
For details, see advertisement in December 19 issue.
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"LOGAN"

AIR OPERATED DEVICES

For every chucking requirement.
Adaptable to all types of machines.
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Sawed from highest grade, selected Talc (or Soapstone)
Positive guarantee of satisfaction

Packed in 1 Gross Boxes
24 Boxes to a Case

In all standard and special sizes

Also Powdered Talc

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This low cost machine will handle any keyseating job in the shop up to 1 in.

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You can teach your shop boy to run a GIANT

The extreme simplicity with which set-ups are made, and operations controlled, on the **GIANT** Keyseater, gives this machine a twofold claim to your careful investigation.

Firstly, there is no need to employ a skilled operator, your apprentice or shop boy can soon be taught to maintain a full ouptut of accurate work. Secondly, the time taken in setting up work has been so shortened that it becomes almost negligible.

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AUTOMATICALLY!

Investigate the advantages of the P&J line of labor saving Automatic Chucking and Turning Machines, models 4-D, 5-D, 6-A and 6-D.

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Don't! It isn't logical. Bulletins on request.

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MILLING MACHINE

The United States Machine Tool Company
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with the Rowbottom name upon them, are your way to cams that require no touching up by hand. Send for a catalog today.

If your cam requirements do not warrant the purchase of one, you practically own a Rowbottom Universal Cam Milling Machine when you give our contract department the order to make your cams.

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For screw machine economy, accuracy and big output

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SPLINE MILLERS
for closed end keyways and through slots.

VERTICAL MILLERS
with circular, contour, spiral and continuous milling attachments.

DRILLING MACHINES
1 to 7 spindles, hand, power and simultaneous feed. Heads, adjustable for variable distances between spindles

PRESSES
Uniform blow, foot or power.

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***The* TAYLOR & FENN COMPANY**
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The National Acme Company
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Makers of Acme and Gridley Multiple Spindle Automatics, Gridley Single Spindle Automatics, and Gridley Multiple Spindle Chucking Machines, at Windsor, Vermont, and Nameo Opening Dies, Collapsing Taps, Screw Machine Products and "Positive" Oil Separators and Clarifiers at Cleveland, Ohio.

DIE SINKING—ENGRAVING & VERTICAL MILLING MACHINES

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Geared for tremendous pulling power. Selective sliding gear transmission for all speeds and feeds.

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See Display in First and Third Issue of Month

S. S. White Flexible Shaft Tools

For Grinding, Burring, Drilling, Assembling, etc.

Or for that matter on any work where portability and handiness are desirable features.

Put S. S. White Flexible Shaft Tools where they are accessible to your high priced skilled mechanics and see for yourself how they will turn out more and better work at considerably lower output costs.

Our illustrated catalog shows dozens of uses in all classes of work. ***May we send it?***

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Industrial Division

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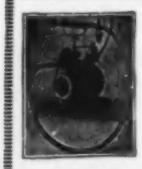
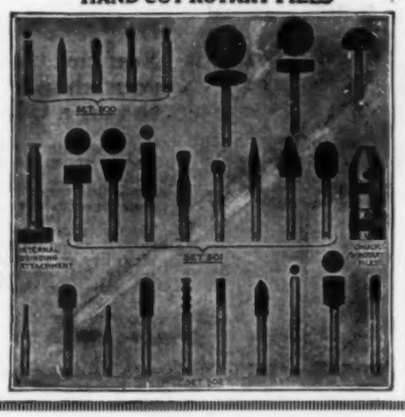
HIGH SPEED HAND CUT ROTARY FILES





Strand

Rotary Files

Used with Strand Flexible Shaft Machines. Are giving excellent service.

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N. A. Strand & Co.
5001 No. Lincoln St.
Chicago

BALANCED-DRIVE

Inverted

Counterbore

An economical tool for back spot-facing inaccessible surfaces. Drive is accomplished through parallel keys which are integral parts of lower end of cutter and provides a balanced drive. Practically entire cutter may be used up due to the drive being at the extreme opposite end from the cutting teeth.

Catalogue No. 28 Upon Request.

ECLIPSE COUNTERBORE COMPANY
DETROIT - MICHIGAN

AMPCO

FORGING AHEAD

"RIGHT TO THE POINT"

Ampco has shown such remarkable growth this year because Tool Superintendents and Production Managers have discovered they can get more work at less cost from each Ampco Tool. Comparative tests won't cost you a cent. Send for Catalog No. 6 and complete information.

AMPCO TWIST DRILL CO.
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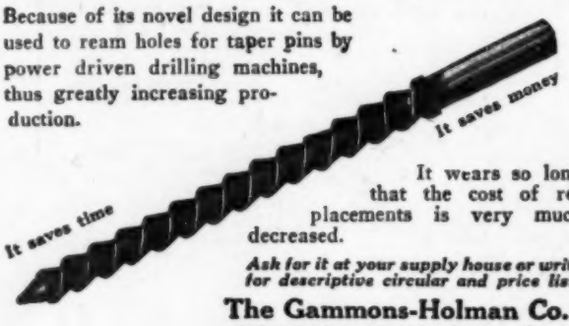
Branches in all principal cities—see telephone directory.

The Gammons Taper Pin Reamer

Because of its novel design it can be used to ream holes for taper pins by power driven drilling machines, thus greatly increasing production.



It wears so long that the cost of replacements is very much decreased.

Ask for it at your supply house or write for descriptive circular and price list.

The Gammons-Holman Co.
405-407 Main St., Manchester, Conn.

Leakless Pipe Joints

Faulty piping systems are the result of poor threads. Pipe taps purchased without considering quality, cut poor threads. Insure unqualified service from your piping systems by specifying Bay State Pipe Taps. Accurate in lead, pitch and diameter; long lived. Bay State Taps, Dies, Drill and Screw Plates are detailed in our Catalog.

BAY STATE TAP & DIE CO.
Mansfield, Mass.

Twist Drills, Reamers

See our Page advertisement, December 5 issue.

Screw Extractors

The CLEVELAND TWIST DRILL COMPANY CLEVELAND

Twist Drills, Reamers Milling Cutters, Hobs Special Tools

NATIONAL TWIST DRILL & TOOL CO. DETROIT U.S.A.

Make sure *your own skill* will not be handicapped

A good mechanic takes pride in his skill, but he also takes pride in the tools he uses.

That is why American Swiss' slogan is "Only the best are good enough."

For 30 years we have been making "only-the-best-are-good-enough" files and discriminating mechanics the country over have come to take added pride in their own skill when expressed thru the medium of American Swiss Files of Precision.

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2400 different sizes, shapes and cuts of American Swiss Files of Precision to choose from

AMERICAN SWISS

files of precision

also manufacturers of mechanics' hand tools and knurls

OK Cutting Tools

For Greater Economy

O K Cutting Tools are the short cut to two-way economies. They are available for use on lathes, boring mills, shapers and planers.

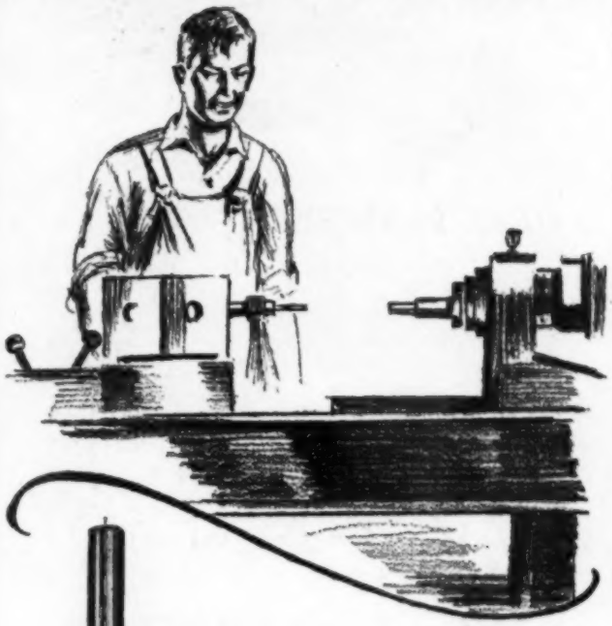
The O K method saves time and permits the operator to spend more time in actual machining as worn-out tool bits may be easily replaced with new. This saving is especially noticeable when the mechanics work on a "piece work" basis.

When a tool bit is worn out only the point is discarded and a new one inserted, thereby preserving the tool holder for future use. A tremendous saving.

Let our engineering staff show you how they can adapt the O K Tool System to your particular needs. Complete details on request.

THE TRADE O K MARK TOOL CO., INC.
SHELTON, CONN.
Sole British Representatives
Richard Lloyd & Co., Ltd., Birmingham, England

OH BOY! They sure did me a FAVOR—



"Oh, Boy! They sure did me a favor when they got this Scully Jones Floating Reamer Holder. No more worries about centers out o' line with tapered holes and bum threads."

The satisfaction of turning out accurate work, can only be had with tools capable of its production. When the center of your lathes or screw machine no longer line it is impossible to do an accurate reaming or tapping job.

The Scully-Jones Floating Reamer Holder eliminates the inaccuracies caused by this condition and the aggravation of rejected and unsatisfactory work.

BOTH FLOATING AND SELF-ALIGNING TYPES

Send in the coupon today and learn more about this wonderful tool.

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THIS MARVEL No. 2

DRAW CUT HACK SAW

AND

THESE MARVEL *High-Speed-Edge* BLADES

are reducing metal cutting costs wherever they are used. The saw itself is ruggedly built to get the utmost in cutting speed from the *high speed steel* cutting edges on the blades. The *unbreakable back* means fewer blades and less time for changing.

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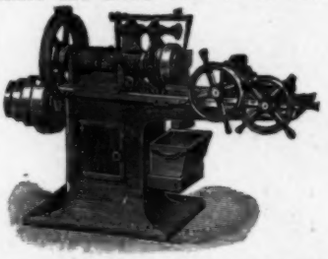
With Acme Bolt Cutters

You can adjust the dies to size without stopping the machine. The bolt cutters are fitted with Acme Die Heads. The dies are made interchangeable with the steel caps and the Die Heads are all lined with hardened tool steel and ground to size. Dies can be changed in less than a minute.



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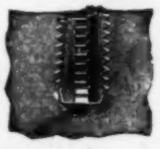
THE ACME MACHINERY COMPANY
Cleveland, Ohio, U. S. A.
Detroit Office: 5185 Loraine St.

Anyone can break a Tap in a Hole



but ordinary methods of removal spoil the thread and scrap the job.

We offer you a tool that will remove broken taps quickly and not harm the threads by the operation.

It is stocked for taps from 3/16-in. to 1-1/4-in.—smaller or larger on order.

Learn all about this low cost tool that usually pays for itself in the first job. Send for descriptive bulletin and prices.

Walton Tap Extractors can be furnished for removing either 3 or 4 fluted Taps of any size.

THE WALTON COMPANY
311 Pearl St., Hartford, Connecticut

Jarvis

Screw Driver and Nut Setter

This clever little device can be adjusted to give any desired tightness or looseness by merely adjusting the spring tension.
Write us for catalog explaining our complete line of Tapping Devices, Quick Change Chucks and Collets as well as Screw Drivers.

THE CHAS. L. JARVIS COMPANY
Gildersleeve, Conn.

DIES TAPS

GEO MET RIC

Right from the Lead

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

"CLARK" Tools Win by Comparison

Switch "Handy to the Hand." Full line of electrically driven drills and grinders.

Send for Catalog

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Louisville, Ky.

Use ARMSTRONG Tool Holders

Save
All Forging
70% Grinding
90% Tool Steel

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
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—Standardize your threads—
by using one make of threading tools

MURCHEY

Self-Opening Dies and Collapsible Taps
101 Varieties—All Adjustable—Write for Catalog

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THE U. S. ELECTRICAL TOOL CO.

Equipped with the highest priced bearing in the world
YOU MAY BUY A BEARING AS A BARGAIN BUT TRY AND GET A BARGAIN OUT OF USING IT
for
Nothing is apt to cost so much as a bearing that cost so little.
SKF
Puts the Right Bearing in the Right Place

"Oldest Builders" of Electric Drills and Grinders Know Their Bearings...and Standardize on SKF

"ONE of the many reasons for the remarkable dependability, economy and long life of the famous U. S. Grinders is their SKF Ball Bearings," says The U. S. Electrical Tool Co. in its advertising and stresses the fact that these are the highest-priced bearings in the world. Placing reliable and trouble-free performance above false economy in the production of its equipment for thirty years has been the policy of the "oldest builders of electric drills and grinders in the world."

The new U. S. Graphitized Micarta Drive Grinders for vitrified and high speed snagging wheels are also 100 percent SKF. Six of these bearings are used... two on the motor and four on the chrome-manganese steel one-piece shaft. Friction has been reduced to the lowest possible point. With wear a negligible factor and no bearing adjustments ever required, the heavy shaft is insured against vibration. Electrical troubles usually due to bearing wear are eliminated. Dust-proof housings effectively protect the SKF Bearings from all grit and abrasive matter and keep the lubricant where it belongs.

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—there it is!

The quick answer to the problem before you!

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THIS handy book provides a quick and accurate help to practicing engineers and students in their daily work. It is a selection of tables containing the Squares, Cubes, Square Roots, Cube Roots, Fifth Roots, Powers, Circumferences, Areas of Circles, Common Logarithms, Trigonometric Functions, Natural Logarithms, Exponential and Hyperbolic Functions and Integrals. All functions are given correct to six decimal places.

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III. Circumferences and Areas of Circles.
IV. Common Logarithms of Numbers.
V. Common Logarithms of Sines, Cosines, Tangents and Cotangents.
VI. Natural Trigonometric Functions.
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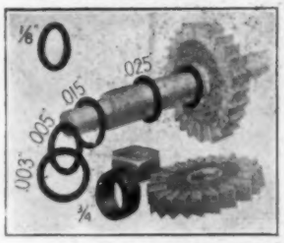
Send for free samples in the sizes you use most.
Stock sizes for arbors of the following diameters:



⅜, ½, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 1¾, 1⅞, 2, 2¼, 2½, 2¾, 3, 3½ and 4 inches and larger.

Stock Thickness: .001, .002, .003, .004, .005, .006, .007, .008, .010, .012, .015, .020, .025, .032, .047, .063, .093, and .125 inch.

Spacers thicker than ⅛" are turned from tubing or bars but not carried in stock.

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Sockethead Cap and Hollow Set Screws

"UNBRAKO" Screws are famous for their unusually accurate and clean threads. The **"UNBRAKO"** won't fracture, won't round in the hex, won't mushroom.

A complete line always in stock. Write us for free samples and Form 398.

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ALLEN Socket-Head *Cap Screws*

The strongest, handiest screws for punch, die and jig work. Can be set up tighter than hexagon head screws; no corners to round off and allow wrench play. Fine for "close work" where there's no room to use an "S" wrench. No slot to spread as in slotted fillisters. Heads are finished all over and turned true to the body of the screw; can be set up in a counterbored hole without grinding off the sides. Cold drawn by Allen process; scientifically heat-treated. Threads die cut, accurate in pitch, perfect in lead *Ask for circular.*

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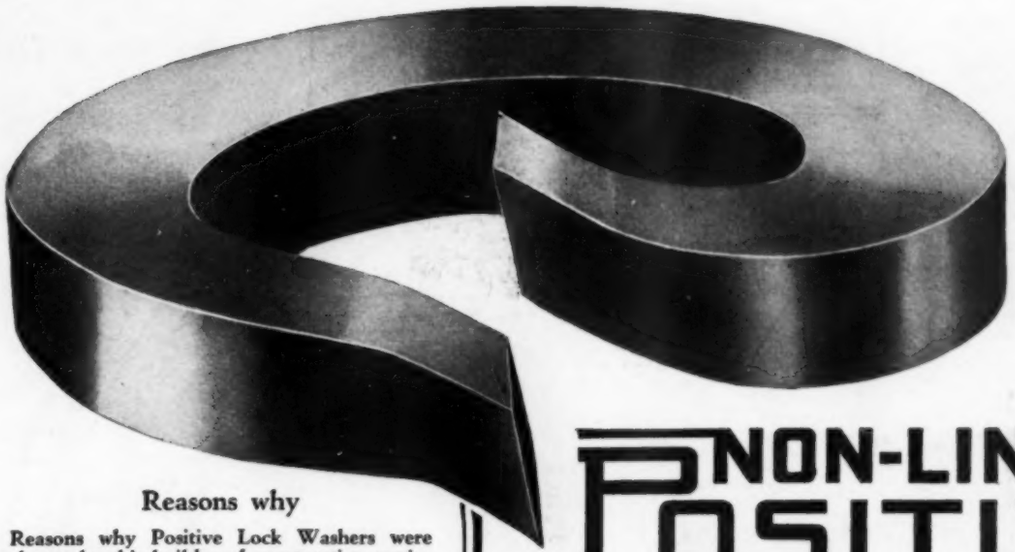
BRISTO

CAP SCREWS

Extra pressure in making a quick adjustment cannot round out the socket or split the screw. Bristos are ideal for the product or the machine making it.

Write for interesting folder.

THE BRISTOL CO., Waterbury, Conn.



Pat. Nov. 13, 1928

NON-LINK POSITIVE Lock Washers

Can save you money too!

If you purchase lock washers on a price basis, Non-Link Positive Lock Washers can save you money; not in first cost but in final costs.

In assembling, too, Non-Link Positive Lock Washers save money. They eliminate the time losses and the troubles caused by tangling.

But most important of all, Non-Link Positive Lock Washers save money for future owners of your product. These lock washers insure permanent security. They do not require frequent costly adjustments.

This combination of four Non-Link Positive Lock Washer features is proof they can save you money: (1) tapered and "barbed" ends, (2) spring-acting body, (3) Non-Linking design and (4) Parkerized Rust-Proofed surface.

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Newark **New Jersey**

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455 Colyton St.

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Reasons why

Reasons why Positive Lock Washers were chosen by this builder of construction equipment are best told in their own words.

Here is a reproduction of page the *reasons* appeared in originally.

Positive Type Lock Washers
Chosen by Koehring Company

"...they are used wherever bolts are used—we use them on all our equipment including excavators, pavers, gasoline shovels, cranes and draglines—we have found them to be more dependable and to give us a greater measure of satisfaction than the ordinary kinds—as Koehring equipment is built of the very best materials obtainable and in the best manner we know how, being throughout real quality equipment."

Koehring Company
Milwaukee, Wis.

Send for Our Catalog
Send for Samples!

THE POSITIVE LOCK WASHER CO.
Newark New Jersey

The Claw-like Ends Bite In—Can't Slip

We also make Plain Type Lock Washers

Like hundreds of other prominent users of Positive Lock Washers, this company finds it pays to specify unit parts of known qualities.

They realize that sales engineering is closely related to product engineering.

Samples for testing purpose furnished on request.

For Nearly FORTY YEARS — LOCK WASHERS Exclusively

Patented Nov. 13, 1928

NON-LINK POSITIVE — POSITIVE TYPE — PLAIN TYPE — KANT-LINK

GENUINE KEYSTONE LOCK WASHERS

MAKERS OF ALL TYPES OF SPRING LOCK WASHERS AND NUT LOCKS

Written by SOCRATES—436-338 B. C.

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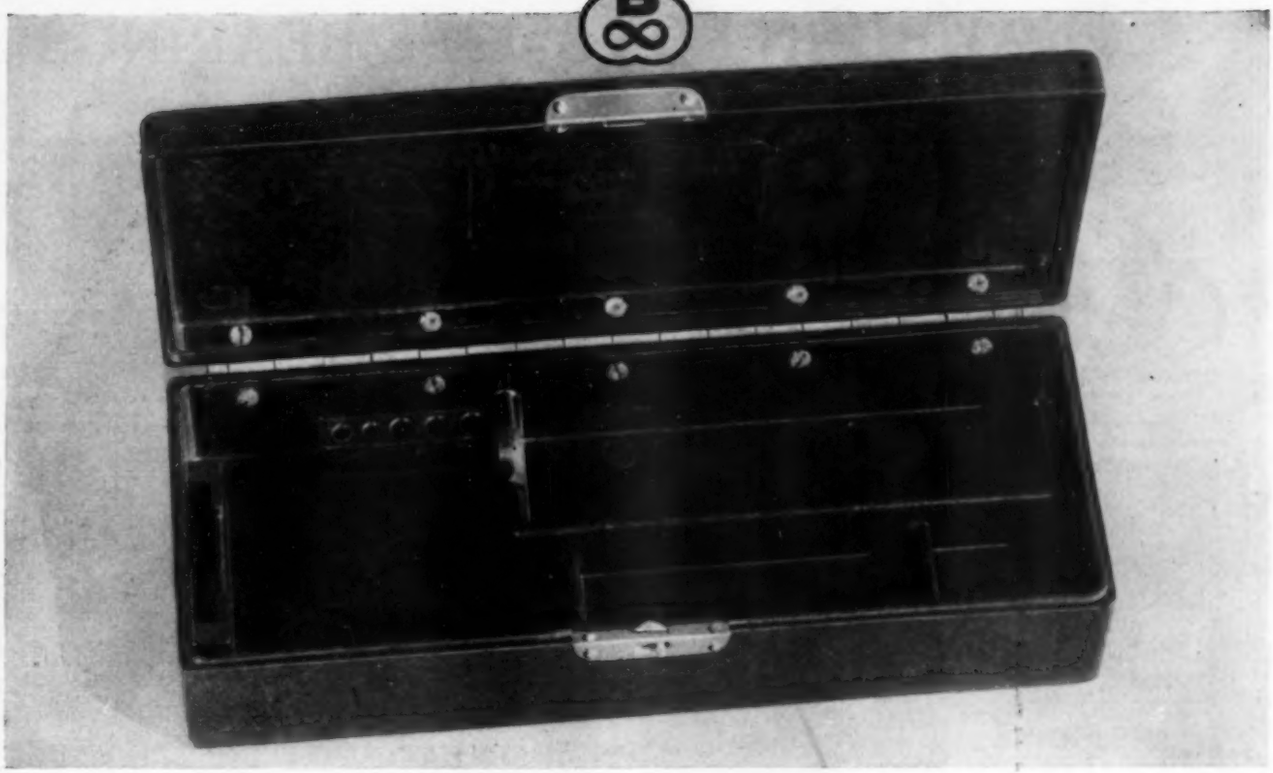
THE OHIO ELECTRIC & CONTROLLER COMPANY
5903 Maurice Avenue
Cleveland, Ohio

OHIO MOTORS



Instrument case formed of Bakelite Molded. Welch-Allyn Co., Manufacturers, Auburn, N. Y.

Instrument cases of *Bakelite Molded* are attractive and easily sterilized

WHEN surgical instrument cases were made in the plush-lined manner, it was impossible to keep these containers sterilized. To overcome this problem, without the use of corroding metal, the manufacturers of the case illustrated, adopted non-hygroscopic Bakelite Molded.

This new Bakelite Molded case is formed in two parts, each completely finished in a single press operation. At the time of molding five compartments and a vertical rack are made permanent parts of the case. The smooth unbroken surfaces of Bakelite Molded simplify cleaning and sterilization.

Bakelite Molded will not corrode nor disintegrate from the sterilizing process. Unlike metal, there is no plating to chip or wear off and the lustrous finish of Bakelite Molded remains attractive through years of service.

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Intimate knowledge of thousands of varied applications of Bakelite Materials combined with eighteen years' experience in the development of phenol resinoids for mechanical uses provides a valuable background for the cooperation offered by our engineers and research laboratories. Write for Booklet 34-M, "Bakelite Molded".

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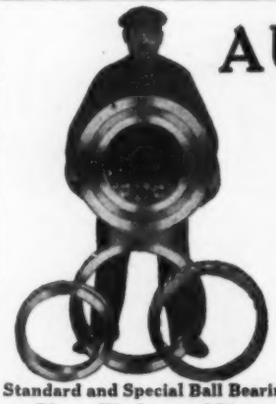

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Thrust Ball Bearings—Built like a Speedway—and Annular Ball Bearings—with Heavy Bronze Anti-Friction Retainers—manufactured in a wide variety of types and sizes to meet many conditions of service. Let us assist you. Bulletins and data sheets upon request.

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AUBURN BALL BEARING CO.

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The Product of America's Foremost Ball Plant

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BALL BEARINGS
(annular and thrust)

ROLLER BEARINGS
(tapered)

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No bends—*no breaks*

Hartford Steel Burnishing Balls and Metallic Burnishing Materials burnish by pressure the same as in hand polishing, but they never bend nor break the metal articles being burnished. They are made in sizes and styles to meet particular needs and practically never wear out. They impart a superior finish and polish thousands of parts in the time required for a few articles by hand work.

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THE HARTFORD STEEL BALL CO.

Makers of Steel Balls for Bearings, Burnishing Balls and materials.

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Ball and Roll Bearings—⅛ to 40 inches in diameter.
ONE OR A MILLION

MAC-IT Safety Set Screws will not become distorted with long use

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PARTS MANUFACTURED IN QUANTITIES.

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For quantity production; *easily machined.* Nickel chromium or manganese alloys if desired. Estimate?
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Carburizing, Hardening, Tempering and Coloring in quantity.
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Have a well equipped plant for the manufacture of medium and light weight machinery, tools, jigs, fixtures and special machine work including gear cutting.
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The finished product produced complete from foundry to shipping platform in one plant with exceptional facilities for medium and small sized work.
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Contract Swaging from Pin Pointing to 5" Stock
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Tools that are time saving.
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Tools that are easy to manipulate.
Tools that will give largest possible production.
Tools that will give absolute interchangeability.
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Have Your Dies, Jigs, Fixtures and Bakelite Molds Made by Krasberg
First Class Work and Service Always
Also Contract Manufacturing of Metal Articles or Parts
37 years of experience in building special machinery
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A.M.

POSITIONS VACANT

Connecticut

POSITION, immediately available with established manufacturer of shop furniture and factory equipment for a man capable of establishing and working with jobbers and manufacturers' agents throughout the country. Willingness to travel extensively and familiarity with light steel fabrication essential. Full particulars in first letter to P-660, American Machinist, Tenth Ave. at 36th Street, New York.

Ohio

ASSISTANT superintendent wanted for prominent machine tool manufacturer operating about 400 men; a man about 40 years of age, in good health, and thoroughly experienced in machine tool building, one understanding modern production methods. State age, experience, qualifications and salary expected. Reply confidentially to P-643, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

DESIGNING engineer wanted for engine lathes; a high grade, thoroughly experienced lathe designer with modern ideas. State age, experience, qualifications and salary expected. Reply confidentially to P-642, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

Wisconsin

MACHINE designers wanted, with experience on electric motors, generators and transformers. Apply by letter with photo. Give experience and salary required. Location, Middle West. P-658, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

Graduate Mechanical Engineer

Experience in Combustion, General Steam and Hydraulic Engineering.

Apply, R. A. DYE
Jones & Laughlin Steel Corporation
Aliquippa, Pa.

SHOP SUPT.

progressive white metal concern can use a shop executive with practical and technical experience. To take floor direction of shop organization. To assist in development work. Preferably a man under 40. In reply state full particulars as to experience.

P-656, American Machinist
10th Ave. at 36th St., New York City.

ENGINEER

mechanical, one who has had at least five years' experience in design of power transmission machinery such as gears, speed reducers, etc.

P-661, American Machinist
Tenth Ave. at 36th St., New York City

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000 and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established twenty years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not a registration bureau. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 266 Main Street, Buffalo, New York.

SINCE 1919, managers, superintendents and other important men in machinery and metal trades have retained us. Individual. Confidential. Business men throughout metal-working industries know us, believe in us. Jacob Penn, Inc., 9 Park Place, New York.

POSITIONS WANTED

Connecticut

GENERAL superintendent or works manager, by a good mechanic and seasoned executive with wide experience on general manufacturing including all departments; 13½ years as superintendent, receptive to make a change. What have you to offer? Address PW-639, American Machinist, Tenth Ave. at 36th St. New York.

MANUFACTURING executive; capable of coordinating all of the departments of manufacturing, having 18 years of practical executive experience, sufficient to be considered an authority. I am a leader of men, one who, through inherent characteristics and experience is capable of weighing the human element in industry. I am what the world calls a "square shooter," able to develop my aides men of the highest calibre and efficiency, who will respect my judgment because of my experience and knowledge, and my character because of my ethics. I have unbounded health, energy and such enthusiasm as inspires me to accomplishment. A frank and full account of my entire experience and connections are available. PW-659, American Machinist, Tenth Ave. at 36th Street, New York.

Illinois

SUPERINTENDENT, works or factory manager, practical and technical training; wide experience, good mechanic and executive, with record of result. PW-664, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

Massachusetts

SUPERINTENDENT or factory manager, 37, practical and technical training, thorough mechanic and seasoned executive; wide business experience, capable of assuming full responsibility and produce results. Available January, 1930. PW-662, American Machinist, Tenth Ave. at 36th Street, New York.

WORKS or production manager, an executive and engineer with over twenty years of practical industrial experience and still in his thirties, desires a permanent connection with some large or fair-sized Eastern manufacturer now experiencing difficulty in producing a quality product at an economical cost. Will consider contract, with remuneration based on accomplishment, or straight salary. Available immediately. PW-645, American Machinist, Tenth Ave. at 36th St., New York.

Many Opportunities—Designers and Detailers Machine Tools, Automatic Machinery, Tools and Dies, Sales. Service to members only except in Chicago and vicinity. Service Department

AMERICAN ASSOC. OF ENGINEERS
8 S. Michigan Ave., Chicago, Ill.

POSITIONS WANTED

New Jersey

YOUNG man, 20, American born, just graduated from Technical Machine Construction School of Vienna, seeks connection with concern where he can work himself up. PW-644, American Machinist, Tenth Ave. at 36th St., New York.

New York

FOREMAN, machine shop or gear manufacturing; 15 years' experience. PW-657, American Machinist, Tenth Ave. at 36th Street, New York.

SPARE TIME WORK WANTED

DESIGNING engineer specializing in the design of gears, speed reducers and individual motor drive. STW-663, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

SALESMAN WANTED

Salesman

Young man, 26; 32 years, selling taps, gages, small tools. Machine shop experience necessary. New York district. Previous selling experience not necessary. Good salary. L. C. Biglow & Co., Inc., 250 West 54th Street, New York.

AGENT WANTED

Manufacturer's Agent

A central state manufacturer of steel factory equipment such as bench legs, benches, drawers, tool stands, stools, racks, trucks, etc., wants a manufacturer's agent in several territories, Boston, New York, Baltimore, Pittsburgh, Philadelphia, Cleveland, Buffalo, and several other industrial centers. In writing, give full details in your first letter as to age, experience, credit references, and details of the lines that you are now handling. AW-665, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

REPRESENTATIVE AVAILABLE

Representative

Well established in New York territory and export trade. Thoroughly familiar with machine tools, general factory equipment, raw materials, manufacturing and selling. Fifteen years representative largest manufacturers, both here and in Europe, is open for proposition. RA-654, American Machinist, Tenth Ave. at 36th St., New York.

Export Trade

Well known house with showroom with demonstration bays located in Birmingham, England, wish to hear from U. S. A. production machinery and tool companies looking for expansion of business in the export markets, and have one of their technical representative in U. S. A. available for immediate interview. RA-648, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

Sales Representative

Former shop executive, six years selling in New York Metropolitan district, desires to specialize on drilling and tapping, or milling equipment. Open to handle two or three accounts or would consider one major account on commission basis. RA-635, American Machinist, Tenth Ave. at 36th Street, New York.

BUSINESS OPPORTUNITY

Capital Raising

Stock and bond selling campaigns planned and executed for companies seeking development. Mergers, reorganizations and new financing by experienced dependable financial organization. Reference exchanged and booklet by request. The Brookworth Co., Inc., 110 East 42nd Street, New York, N. Y.

Professional Services on Page 114

ReMANUFACTURED
-(ORIGINATED BY US)-
MACHINE TOOLS
REG. U. S. PAT. OFF.

Low-cost

machines that will produce as accurately and as rapidly as new

Partial List Only

Lathes

1—66"x21' Putnam.
1—48"x50' Pond.
1—48"x20' Fitchburg.
1—45"x24' Pond.
1—42"x71' American Gd. Hd.
1—42"x34' American Gd. Hd.
1—42"x26' American Gd. Hd.
1—36"x71' American Gd. Hd.
1—36"x42' Gisholt Gun Borer.
1—36"x34' American Gd. Hd.
1—36"x26' American Gd. Hd.
1—36"x14' Johnson.
1—30"-34½"x12' L. & S. Sel. Gd. Hd.
1—30"-34"x12' L. & S.
1—30"x11' H. S. & G.
3—26"x18' Bridgeford.
3—26"x16' N.-B.-P.
3—26"x16' Whit.-Blaisdell.
10—26"x16' Bridgeford.
3—26"x14' Bridgeford.
5—26"x14' N.-E.-P.
3—26"x13' Wickes.
3—26"x12' Putnam.
5—26"x12' Bridgeford.
13—26"x11' Wickes.
40—26"x10' N.-B.-P.
15—26"x10' Canada.
15—26"x10' Whit.-Blaisdell.
14—26"x10' Bridgeford.
11—26"x9' Bridgeford.
4—26"x8' Bridgeford.
1—26" LeBlond Crank Shaft Lathe.
9—25"x12' LeBlond.
1—24"x10' Cisco.
5—20x22"x12' American.
2—20-22"x8' American M.D.
30—20-22"x8' American.
1—19"x12' LeBlond G.H.
1—18"x9' Chard.
1—16"x12' Sundstrand Mfg.
1—16"x10' Sundstrand Mfg.
3—16"x8' American Gd. Hd.
1—16"x8' Hendey.
1—14"x12' LeBlond Gd. Hd.
1—14"x10' Pratt & Whitney.
1—14"x6' LeBlond.
2—14"x6' Lodge & Shipley.
2—14"x6' Flather.
5—3⅛"x60' Fitchburg Loswing.
1—3⅛"x108' Loswing.

Vertical Milling Machines

1—No. 1 Becker.
1—No. 2 Brown & Sharpe.
1—No. 2 Cincinnati.
1—No. 5 Becker.
1—No. 5-B Becker.
1—No. 5 Brown & Sharpe.
6—No. 6 Becker.
1—Model CS Becker.
2—Model SD Becker.
1—Model ACS Becker.

Planers

1—72x84"x12' Gray.
1—60x48"x12' N.-B.-P.
1—50"x50"x32' Cincinnati.
1—50"x50"x16' Cincinnati.
1—48x48"x16' N.-B.-P.
1—48x48"x10' Gray.
1—48x48x10' N.-B.-P.
3—36x36"x18' Cincinnati.
1—36x36"x16' Ohio.
1—36x36"x16' N.-B.-P.
1—36x26"x10' Whitcomb-Blaisdell.
2—36x30"x8' Ohio.
1—36x32"x8' Cincinnati.
1—30x30"x14' Niles-Bement-Pond.
1—26x26"x10' Gray.
2—24x24"x6' Gray.
1—24x24"x6' Flather.
2—24x24"x6' Woodward-Powell.
1—24x24"x6' American.

Vertical Boring Mills

1—14'-20' Niles Extension.
1—10' Niles.
1—96" Betts.
1—72" Pond.
1—72" Niles.
1—72" Bickford.
1—61" Baush.
1—60" Pittsburgh.
1—54" Bullard.
1—52" Gisholt.
1—51" Baush.
1—51" Bullard.
1—48" Colburn.
2—42" Gisholt.
3—42" King.
1—42" Colburn.
1—36" Bullard Rapid Prod.
2—36" Gisholt.
2—32" King.
1—30" Flather.
1—30" Gisholt.

Milling Machines

1—No. 5 Cininnati.
1—No. 5-B Becker-Brainard.
3—No. 3 Cincinnati.
1—No. 3-8 Cincinnati.
3—No. 3 Brown & Sharpe.
1—No. 2-B Milwaukee.
1—No. 21 Brown & Sharpe.
2—No. 2-Y Brown & Sharpe.
1—No. 1-B Milwaukee.
2—No. 1 Brown & Sharpe.
2—No. 20 Oesterlein.
1—No. 1½ Rockford.
7—No. 25 Becker.
1—No. 3-H LeBlond Univ.
1—No. 2-B Milwaukee Univ.
1—No. 2-M Cincinnati Univ.
1—No. 1 Kempsmith Univ.
3—Type B Briggs.
1—12" Cininnati B. G. Mfg.
1—Putnam, Semi-Auto.
3—No. 33 Kempsmith Mfg.
175—P. & W. Hendey, Becker and Garvin Lincoln Millers.

Auto Screw Machines

2—No. 52 National Acme.
1—1x5" 6-spdl. New Britain.
1—No. 33 New Britain.
1—No. 2-P Potter & Johnston.
4—No. 5-A Potter & Johnston.
6—No. 6-A Potter & Johnston.

OUR GUARANTEE:

Your money back if you return a machine within thirty days. No excuses necessary.

Hand Screw Machines

1—No. 10 2" Bardons Oliver.
3—No. 8 3⅝" Warner Swasey.
1—No. 10 Foster.
1—No. 7 Foster.
1—No. 6 2¼" Warner & Swasey.
2—16x50" Norton.
1—1⅜" D. & W.
1—No. 1 Foster.

Turret Lathes

2—26" Libby.
26—24" Davis.
8—24" Steinle.
5—24" Gisholt.
3—21" Gisholt.
1—20" Gisholt Auto.
1—18" Libby.
1—No. 3 Cincinnati Acme.
1—No. 2-A Warner & Swasey.
1—No. 3-A Warner & Swasey.
1—No. 6 W. & S.
1—21x8" LeBlond.
2—No. 6 Brown & Sharpe.
2—3x36" Jones & Lamson.
3—2-spdl. Jones & Lamson.
1—18" W. & S.
1—16" Cincinnati-Acme-Fox.
1—14" Warner & Swasey.

Gear Cutters and Hobbers

1—No. 5 60" Brown & Sharpe.
3—No. 36-H Gould & Eberhardt.
1—36"x12" G. & E.
4—No. 12 Barber-Colman.
1—No. 3 24" Brown & Sharpe.
4—No. 6 Fellows.
1—No. 61 Fellows.
1—12"x24" G. & E.
1—12"x10" G. & E.
1—No. 3 Barber-Colman.

Radial Drills

3—3' Western.
1—3' American Sens.
1—2⅛" Gang.

36"x36"x18' Cincinnati Planer
Reversing Motor Drive or Belt Drive

Slab Milling Machines

1—24x13"x20' Ingersoll.
3—24x24"x12' Ingersoll.
1—36x30"x7' Newton.
1—45x17½" Ingersoll.
1—50"x20' Ingersoll.
1—No. 3 92x54"x15' Beaman & Smith, Milling and Boring Machine Planer Type.
1—Beaman & Smith open side.
1—3 spdl. Beaman & Smith.

Horizontal Boring Machines

1—No. 1 Cleveland.
1—5" Bar Ingersoll.
1—2-spindle Espen-Lucas Boring, Milling and Drilling Machine.
1—Beaman & Smith Cylinder Boring and Milling Machine.
1—No. 3 Barnes Hor. Radial.
4—No. 1 Barrett.
2—No. 2 Rockford.
1—7"x60" Springfield Spindle Borer.

Presses

1—No. 54 Bliss.
1—No. 4 Walsh O. B. I.
1—No. 4½ R. & K.
1—No. 10 Zeh & Hahnemann.
1—No. 73½ Bliss.
1—No. 57 Toledo Nosing Press continuous stroke.
5—No. 58 Toledo Nosing Press continuous stroke.
1—No. 59 Toledo Doub. Grdr.

Drill Presses

1—2-spindle H. & W.
1—4-spindle Allen.
1—6-spindle H. & W.
1—No. 2 4-spindle Foote-Burt.
1—No. 4 6-spindle Foote-Burt.
1—No. 4 4-spindle Foote-Burt.
1—No. 17 2 or 4-spindle Foote-Burt.
2—No. D-31 Fox Mult.
1—No. 12-C Fox Mult.
1—No. 12 Natco Mult.
1—No. 14 Fox Mult.
1—32" Barnes, Self-Oiling.
2—24" Foote-Burt.
1—21" Weigle.
1—No. 2 Western Mult.
1—No. 3 Western Mult.

Shapers

1—16" Barker.
1—16" Columbia.

Grinders

1—96"-37½"x96" Norton Gap.
1—18x96" Norton.
1—16x52" Landis.
1—16x48" Landis Crank Pin Grinder.
1—14x72" Norton.
2—14x50" Norton.
5—14x36" Norton.
2—12x36" Modern.
3—10x72" Norton.
2—10x72" Landis.
3—10x52" Landis.
8—10x50" Norton.
4—10x36" Norton.
5—10x36" Landis.
2—10x24" Landis.
1—10x24" Norton.
1—No. 40 Bryant Wide Wheel.
2—No. 12 8x36" B. & S.
10—6x32" Norton.
1—5x18" Ott Plain Grinder.
1—No. 2 Bath Universal.
1—10x36" Thompson Universal Cutter Grinder.
2—No. 1 Landis Univ.
1—No. 60 Heald.
8—No. 70 Heald.
1—No. 10-A Bryant Internal.
2—No. 20 Bryant Internal.
1—18" Graham Surf.
1—No. 1 Modern Univ.

Write for photoprints, descriptions and prices

HILL, CLARKE & CO.
OF CHICAGO

651 W. Washington Boulevard, Chicago
Cable Address: REMAND Phone: Haymarket 7660

A SAFE BUY AT VERY GREAT SAVINGS
MOREY GUARANTEED REBUILT MACHINE TOOLS
Large Selection of Choicest Makes—Prompt Shipments

BORING MILLS
3—Bullard 24-in., 36-in., 42-in. N.E.
1—Bullard 36-in. R.P. side head.
2—Gisholt 52-in., 60-in.; 2 heads.
1—Betts 6-ft., cone dr.
1—Betts 10-ft., DC MD.
1—Sellers 72-in. ver. 2 heads.
1—Pond 10-24-ft. ver.
1—N.B.P. 10-16-ft. ver. 2 heads.
1—Betts 12-ft. ver. 2 heads.
1—Niles 14-ft. vertical.
1—Niles 16-24-ft. Extension, ver.
1—Barrett No. 3 Horiz.
1—Landis, No. 35 horiz.
1—Bement 50-in. duplex horiz.

DRILLS—Multiple Spindle
14—Baush Nos. 1, 2.
2—Fox D-31.
1—Moline No. 5-D Cyl. Borer.
3—Natco Nos. 11, 12.

DRILLS—Upright
2—Barnes 20-in. and 24-in. Camel.
5—Detroit 5-spindle.
1—Foote-Burt 4-spindle.
7—Henry & Wright 2, 4, 6 spdl.
2—P. & W. No. 2 Gun.
1—New Turner No. 3 Ver.

DRILLS—Radial
1—American 3-ft. MD.
1—Baush 6-ft.
2—Dreses 4-ft., 6-ft. Pl.
1—American 6-ft. triple pur.
1—N.B.P. 96-in. Plain.

GEAR CUTTERS
7—B. & S. 3x26, 3x36, 4x36.
3—B. & S. No. 6, 60-in. cap.
1—B. & S. No. 13.
6—Cincinnati 16-in. Hobbers.
6—Barber-Colman No. 12.
2—Gould & Eberhardt No. 36-H, 18-H.
3—Fellows Gear Grinders.
6—Fellows Nos. 6, 61, 65, 615.
3—Gleason 6-in., 11-in., 18-in.

GRINDERS
9—Landis 6x18, 10x24, 10x36, 12x36, 12x96 Pl.
6—Norton 3x18, 6x32, 10x24, 10x36, 10x50, 16x36, 10x72.
1—Norton 20x144-in. Gap MD.
1—Norton 24x144-in. Gap MD.
1—Norton 16x50 Crank.
2—Landis 10x52 Cam.
1—Blanchard No. 16 Surf.
2—Diamond Nos. 2 and 3 Surf.
12—Heald Nos. 60, 65, 70, 75, 80.
1—Bath Spline.

HAMMERS
1—New Bradley 20-lb. Helve.
1—Chambersburg 400 Bd. Drop.
1—Billings & Spencer 806-lb. Drop.
1—Toledo 1500-lb. Bd. Drop.

MILLING MACHINES
1—Brown & Sharpe No. 37 duplex.
6—B. & S. Nos. 2, 2-B, 4-B, 5-B Pl.
10—Cin. Nos. 1½, 2, 3, 3-8, 4, 5 pl.
1—LeBlond No. 4-G pl.
1—B. & S. No. 1½ Univer.
1—Kempsmith No. 3 Univ.
1—LeBlond No. 3 Univer.
8—Briggs Type "A" Mfg.
1—Briggs Type "B" 72-in. table.
1—Ingersoll 24x24-in.x10-ft.
13—Becker Nos. AB, CI, 6 Ver.

PLANERS
1—Detrick & Harvey 30x10-ft., single hd. Openside.
1—Detrick & Harvey 96x48x20-ft. openside.
1—Gray 38x38x20-ft., 3 heads.
1—Cincinnati 48x48x16-ft., 4 hds.
1—Gray 48x48x12-ft. 2 heads.
1—Gray 60-in.x48-in.x12-ft., 2 hds.
1—Pond 72x27x20-ft.; 4 heads.

SHAPERS AND SLOTTERS
1—Potter & Johnston 15-in. shaper.
1—Gould & Eberhardt 16-in. shaper.
1—Gould & Eberhardt 24-in. shaper.
1—Niles 20-in. shaper.
1—Niles 18-in. Slotter.
1—Bement 20-in. Crank Slotter.
1—Bement 36-in. Crank Slotter.

AUTOMATIC SCREW MACHINES
14—Cleveland ⅝-in., ⅞-in., ⅝-in., 4¼-in. "A."
4—Cleveland ⅝-in., ⅜-in., ½-in., 1¼-in. "B."
17—Gridley ⅝-in., ⅞-in., 1¼-in., 1⅜-in., 1⅝-in., 2¼-in., 4-spindle.
11—Gridley 3¼-in., 4¼-in., 2¼-in. single spindle.
6—New Britain Nos. 23, 24, 33.
3—National Acme Nos. 52, 56, 515.
11—P. & J. Nos. 5-A, 6-A.

TURRET AND SCREW MACHS.
1—Acme Fox Monitor.
6—Foster Nos. 2, 4, 5, 6.
4—Greenlee 2¼x26.
2—Acme 3¼ x 36.
10—J. & L. 2¼ x 24, 3 x 36.

LATHES
2—Hendey 16x6, 16x8-ft. grd. bd.
2—Sebastian 18-in.x5-ft.
2—Springfield 18-in.x10-ft.
1—LeBlond 23-in.x10-ft. SPD.
1—Reed-Prentice 24-in.x12-ft. MD.
1—F. E. Reed 32-in.x27-ft.
1—Niles 38x24-ft.
1—Boye & Emmes 24-in.x12-ft.
1—LeBlond 25-in.x16-ft.; cone dr.
3—LeBlond 26-in.x10-ft. Dupl. Crk.
1—Reed-Prentice 27-in.x12-ft. S.P.D.
1—LeBlond 36-in.x30-ft. triple. gd.
1—McCabe 48-in. dble. spdle.
1—N.B.P. 42-in.x24-ft.
7—LeBlond No. 12 Multicuts.
Lathes of all sizes and types.

MISCELLANEOUS
Lapointe Broaches (Hudson & New London), 1, 2, 3 and 4.
1—Laidlow-Dunn & Gordon 17x16 Air Compressor.
3—Clayton Air Compressors.
3—Keller E-3 Engravers.
1—Gorton No. 1-D Engraver.
5—Fischer No. 1 Oil Groovers.
1—Wickes Single End Punch.
1—Espen Lucas 44-in. Cold Saw.
1—Campbell 3/16-in. Nibbler.
1—Allen 10-ft. Reach Port. Riveter.
1—Nilson 3-slide Wire Former.
1—Shuster ⅛-in. Wire Straight.
1—Southwark Hydraulic Bend. Roll.
1—Murchey Duplex Nipple Cutter.
1—Garvin 24-in. Cam Cutter.
1—Niles 400-ton Wheel Press.
2—Ferracute C-4, C-5 Press.
1—Bliss No. 1 Toggle.
2—Bliss No. 20. 1—V & O No. 62.

Look Over Our Bargains In Good Used Machine Tools That Are Not Rebuilt

MOREY AND COMPANY, Inc.
410 BROOME ST., NEW YORK, N. Y.
Telephone, Canal 5360

CHOICE
POWER PRESSES

1—No. 8-G ROCKFORD
Double Crank, 71-in., Geared

1—No. 46 BLISS
350 Ton, Geared

1—No. 76½-B BLISS
Overhanging, Geared

2—No. 78½ BLISS
350 Ton, Tie-Rod

1—No. 25-E BLISS
Double Crank, Overhanging Tie-Rod, Geared, New

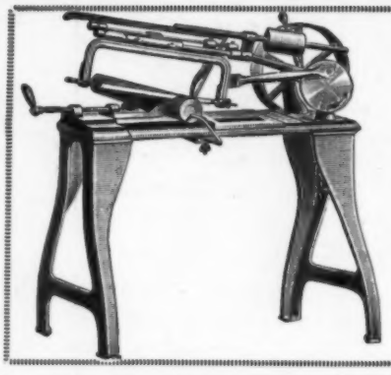
1—No. 13 BLISS
Toggle, Tie-Rod

1—No. 98-F TOLEDO
Triple Crank, Tie-Rod
168" Between Uprights

20—DOUBLE CRANK TIE-ROD PRESSES
BLISS, TOLEDO, CLEVELAND

1200 PRESSES IN STOCK
Don't Fail to Send Us Your Inquiries

JOSEPH HYMAN & SONS
PRESS SPECIALISTS
Tioga, Livingston and Almond Sts.
PHILADELPHIA, PA.



100 New Hack Saws

Made by Millers Falls Company and in original crates. Capacity 4½-in. dia., weight 200 lbs. Known as their No. 89. Uses 10-in. to 12-in. blades.

Self feeding, automatic stop, 45 strokes per minute, 1/3 hp. required.

Price, Each, F.O.B. Bridgeport, Conn., **$35.00**

If check accompanies order, will include 24 New Saw Blades free.

J. L. LUCAS & SON, Inc.
Bridgeport, Conn.

"Do not look upon the vessel but upon that which it contains."

DELTA
EQUIPMENT COMPANY
148 N. 3rd St. Philadelphia Pa.

Select your equipment from these select lists!

Only a few Delta Used Shop Tools are listed here. Write for complete lists.

BOLT AND PIPE MACHINES
2-in. Landis, Single Head Bolt Cutter, with bolt and pipe dies.
6-in. Williams Pipe Machine, capacity 2½ to 6 in. inclusive, single pulley drive.
12-in. Williams Pipe Machine, capacity 2½ to 12 in. inclusive, single pulley drive.

DRILLS
24-in. Cincinnati Bickford S.H.
26-in. Prentice S.H., single pulley drive.
No. 5 Fox Multiple Spindle.
Four Spindle Allen Hi-speed, ball bearing.
Four Spindle Henry & Wright Hi-speed, ball bearing.

LATHES
14-16-in.x8-ft. American Q.C.G.
16-in.x6-ft. Lodge & Shipley, Patent Head, taper attach.
16-in.x8-ft. Monarch D.B.G., Q.C.G., taper attach.
18-in.x21-ft. Hamilton.
19-in.x14-ft. LeBlond Heavy Duty, Q.C.G., motor driven.
20-in.x8-ft. Monarch D.B.G. Q.C.G.

TOOL ROOM TOOLS
16-in.x6-ft. Hendey enclosed belted motor drive with motor. Serial No. 25988.
15-in. Potter & Johnston Shaper.
No. 2 Brown & Sharpe Surface Grinder.

SIMMONS "RESTORED" MACHINES

A few selections from our stock of 2,000 guaranteed "Restored" machines

MILLERS
1—No. 2 Brown & Sharpe Vertical
5—No. 8B Becker Continuous
3—No. CS Becker Continuous
1—No. 4-B Milwaukee Vertical
1—No. 4 Cincinnati Vertical
1—No. 3 Cincinnati Vertical
1—No. 5 Brown & Sharpe Vertical
2—No. 14 Garvin Vertical
9—No. 20 Garvin Vertical
1—No. 4 Cincinnati Universal
1—No. 6 Cincinnati Universal
1—No. 1 ½ Hendey Universal
1—No. 1-B Milwaukee Universal
1—No. 25 Ohio Universal
1—No. 4 Cincinnati Plain
2—No. 3 Kempsmith Plain
1—No. 3-B Milwaukee Plain
5—No. 3 Cincinnati Plain
2—No. 3 LeBlond Plain
1—No. 2 Cincinnati Plain
1—No. 1 ¼A Milwaukee Plain
1—No. 1A Milwaukee Plain
2—No. 1 ½ Brown-Sharpe Plain
1—No. 1-B Fox Plain
1—72x72x24′ N-B-Pond Plain Type
2—66x62x15′ Ingersoll Plain Type
1—59″x20″x12′ Ingersoll Plain Type
1—50″x40″x12′ Newton Plain Type
1—48″x48″x12′ Ingersoll Adj. Rail
1—48″x42″x8′ Ingersoll Adj. Rail
1—40″x22″x6′ Ingersoll Plain Type
1—32″x28″x10′ Ingersoll Plain Type
3—No. 7-H Becker-Lincoln
1—No. 3 ½ Pratt-Whitney Duplex
1—No. 2 Garvin Duplex
1—28″ Cincinnati Automatic
2—18″ Cincinnati Automatics
1—No. 3 Lees-Bradner Thread
1—12″ P. & Whitney Automatic

GEAR MACHINERY
9—18″ Gleason Generators
1—24″ Gleason Planer
1—No. 12-H G. & E. Hobber
1—No. 24-H G. & E. Hobber
1—No. 36-R G. & E. Rack
1—No. 3 Barber-Colman Hobber
1—No. 12 Barber-Colman Hobber
1—No. 96-H G. & E. Hobber
1—No. 13 B. & S. Spur-Bevel

1—No. 1 Standard Automatic
1—No. 3 Cincinnati Automatic
1—No. 4 Cincinnati Automatic
1—36″ G. & E. Automatic
1—90″ Pratt-Whitney
1—No. 6 Fellows Shaper

LATHES
7—14″ Fay Automatics
1—90″ Putnam Wheel
1—82″x36′ Pittsburgh
1—72″x56′ N-B-Pond
1—60″x21′ Pittsburgh
1—50″x36′ Pittsburgh
1—48″x22′ N-B-Pond
1—48″x14′ N-B-Pond
6—42″x39′ Putnam
1—42″x24′ N-B-Pond
1—36″x36′ Putnam
1—36″x14′ Bridgeford
1—36″x14′ Putnam
1—30″x14′ Pond
1—30″x12′ W-Blaisdell
1—28″x18′ Schumacher-Boye
2—26″x12′ N-B-Pond
2—25″x13′ LeBlond
2—24″x16′ Reed
1—24″x14′ Reed-Prentice
1—24″x12′ Prentiss
1—24″x10′ LeBlond
1—20″x10′ Flather
1—26″x24′ G-Klusman Grd. Head
1—20″x20′ Reed
1—18″x10′ Mueller
1—18″x10′ Lodge-Shipley
1—17″x10′ LeBlond
2—17″x8′ LeBlond
1—16″x16′ Greaves-Klusman
4—16″x8′ Hendey
1—16″x8′ G-Klusman
3—16″x5′ Monarch
1—14″x6′ American
1—12″x5′ LeBlond
1—8″x60″ Lo-Swing

PLANERS
1—10′x10′x20′ Bement M.D.
1—10′x6′x16′ N-B-Pond M.D.
1—72″x72″x18′ D. & H. Openside
1—72″x72″x16′ Cleveland Openside
1—60″x60″x14′ Powell M.D.
1—48″x48″x14′ W-Powell M.D.
1—48″x48″x12′ N-B-Pond M.D.
1—48″x42″x12′ D. & H. Openside
1—36″x36″x14′ N-B-Pond
1—36″x24″x12′ D. & H. Openside
1—36″x36″x10′ Gray, M. Drive
1—36″x36″x10′ W-Powell
1—36″x36″x10′ N-B-Pond
1—30″x30″x18′ Cincinnati
1—30″x30″x12′ N-B-Pond M.D.
1—36″x26″x6′ Gray Planer
3—24″x24″x10′ W-Blaisdell
1—24″x24″x8′ Cincinnati

DRILLS
1—7′ Dreses Plain Radial
1—6′ Bickford Plain Radial
1—6′ American Universal
1—5′ N-B-Pond Universal
1—5′ Western Plain Radial
1—5′ Cin-Bickford Plain
1—5′ American Triple Purpose
2—4′ Cin-Bickford Plain
1—4′ Bickford Plain Radial
1—3′ American Plain Radial
1—3 ½′ American Plain Radial
3—No. 4-D Colburn Heavy Duty
2—No. 2-D Colburn Heavy Duty
1—No. 1-D Colburn
1—No. 310 Baker Heavy Duty
1—42′ Cin-Bickford S. Head
1—34″ Prentiss Sliding Head
1—30″ Snyder Sliding Head
1—26″ Prentiss Sliding Head
1—24″ Aurora Sliding Head
2—No. ¼ Avey BB Bench
1—No. 2 Avey High Speed
1—No. 2 Allen High Speed
1—No. 2-B Edlund Two Spindle
2—23″ Rockford Three Spindle
1—No. 2 Avey three spindle
2—23″ Rockford Four Spindle
1—Four Spindle L. Gifford BB
1—Four Spindle Avey No. 2
1—7-Spindle H. & Wright Class B
1—No. 4 Baush Multiple
1—No. 11-D Moline Multiple
1—No. 15 Natco Multiple
1—No. 30 Natco Multiple

SHAPERS and SLOTTERS
1—14″ Rockford Shaper
2—16″ Stockbridge
1—18″ Smith-Mills
1—20″ Stockbridge
1—20″ Kelley
1—30″ American
1—24″ G and E Shaper
1—24″ Simmons
1—10″ Dill Slotter
1—15-18″ Dill
1—15″ Newton
1—20″ Bement

BORING MILLS
1—14′ Niles Heavy, Vert.
1—12′ Niles Extra Heavy Vert.
1—10-16′ Niles Extension Vert.
1—100″ Sellers Vert.
1—96″ N-B-Pond Vertical
1—72″ N-B-Pond Vertical
1—62″ N-B-Pond Vertical
2—44″ N-B-Pond Vertical
1—44″ Putnam Vertical
1—42″ Bullard Rapid Production
1—36″ Bullard Rapid Production
1—24″ Bullard Rapid Production
1—No. 1 D & Harvey Horiz.
1—No. 8 Barrett Horizontal
1—5 ½″ Bar Betts Horizontal
1—6″ Bar Espen Lucas Horizontal
1—7″ Bar Newton Horizontal

MISCELLANEOUS
2—No. 3-A LaPointe Broach
1—No. 4 LaPointe Broach
1—No. 0 W-White Bulldozer
2—No. 1 W-White Bulldozer
1—No. 2 W-White Eyebender
1—50-lb. Bradley Hammer
1—100-lb. Bradley Hammer
1—125-lb. Bradley Hammer
1—No. 3 ½ Baker Keyseater
1—No. 5 Baker Keyseater
1—7″ Baker Tapper
2—No. 2 Garvin Tappers
1—1 ¼″ Ajax Upsetter
1—1 ½″ Acme Upsetter
1—XB Type Imperial Compressor
1—No. 167 ¼ Toledo Toggle
1—3 ½-A Bliss Toggle

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60-in.x84-in.x16-ft. **Gray Spur Gear Planer,** 4 heads.
60-in.x60-in.x16-ft. **Niles - Bement - Pond Planer,** 4 heads.
36-in.x36-in.x16-ft. **Whitcomb Spur Gear Planer,** 2 heads.
17-in.x17-in.x6-ft. **Whitcomb Spur Gear Planer.**
26-in. **Bullard New Era Vertical Turret Lathe.**
No. 13—**Brown & Sharpe Plain Miller.**
No. 13—**Brown & Sharpe Gear Cutter.**
5-ft. **Prentice Radial Drill.**
No. 3 **Brown & Sharpe Cutter & Reamer Grinder.**
No. 0 **Brown & Sharpe Plain Hand Screw Machine.**
16-in. **Warner & Swasey GFH Screw Machine.**

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20 in. **Steptoe.**
24 in. **Gould & Eberhardt.**
28 in. **Columbia** Heavy Duty.
36 in. **Morton** Draw Cut.

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Saginaw W. S., Mich.

Sibley 24-in. Drill Sliding Head B. G. P. F.
Myers 14-in. Drill with rd. and sq. tables.
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Consolidated No. 3 Flywheel Press 2-in. Stroke.
American No. 2 Gas Forge.
American No. 16 Oven Furnace.
Warner & Swasey 14-in. Turret Lathe.
Cataract Prec. Bench Lathe 7x32, ⅝-in. col. cap.
Burke No. 2 Bench Miller P. F.

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170 Summer St., Boston, Mass.

BOLT CUTTERS	1″ Wells, sgl. hd.
	2″ Landis, Dbl. Hd.
BORING MILLS	24″ Bullard, Prod. Type
	42″ Bullard "New Era Type"
	42″ Gisholt, Vertical
	96″ Niles, Vert. 2 Heads
BORING MACHS.	3 ⅛″ bar, D. & H.
	No. 31 Lucas, Hor. 2 ½″ bar.
	No. 5D Moline 6sp. "Hole Hog"
DRILL	D66 Moline, 4 sp. "Hole Hog"
	No. 30 Natco, 48 spindles
	32 in. Hamilton, sliding head
	Radial, 3′ Marsch, sens. MD
	Radial, 3′ Cincinnati-Bickford
	Radial, 2 ½′ Mueller
	Radial, 5′ Cin.-Bickford Univ.
	Radial, 6′ American
GRIND	Two No. 11 B & S 6x32″ Plain
	10″x50″ Norton Plain
	No. 16 B & S 10″x72″ pl.
	No. 1 W & M Universal
	No. 1 Diamond 24x12x12″ surf.
HOBBERS	Nos. 3 and 12 Barber-Colman
KEYSEATER	No. 3A Mitts & Merrill
LATHES	14″x5′ Hendey
	14″x8′ American, motor drive
	18″x8′ Bradford
	24″x16′ American
MILLERS	No. 5-B Becker, Vertical
	No. 2 Kempsmith, Universal
	No. 3 Cincinnati, Universal
PIPE MACHINES	6″ Eaton Coe & Burnham
	6″ Landis
PLANERS	22″x22″x5′ Gray
	30″x30″x8′ Gray
	16′ Niles Plate
PRESSES	Nos. 3 and 4 American Can Obi
	No. 12 Toledo Horning
	No. 5 Bliss, Geared
RIVETERS	No. 3A High Speed Hammer
	30-Ton Hanna, 48″ Throat
SAW	No. 12B Higley, Cold Metal
SCREW MACHS.	No. 7 Foster, 2 ⅛″ cap.
	Nos. 53 & 53 Nat. Acme Auto
SHAPERS	16″ Cincinnati, B. G.
	14″ Gould & Eberhardt, B. G
	20″ Gould & Eberhardt, B. G.
SHEAR	10′ Bertsch 12 ga.
WOODWORKER	No. 58 Crescent, M. D.

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26 Spindle No. 3 **Baush.**
26 Spindle No. 31D **Fox.**
24 Spindle No. 13 **Pratt & Whitney.**

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Saginaw W. S., Mich.

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24-in. Bullard New Era Vertical Turret Lathe	$2750
2—24-in. Bullard Vertical Turret Lathes, New Era Head	1750
2—14-in. Pratt & Whitney Vertical Surface Grinders, plain bearing, chuck	1150
1—14-in. Pratt & Whitney Vertical Surface Grinders, ball bearing, chuck	1450
70 Heald Internal Grinders, excellent.	775
10x24-in. Landis Universal Grinder	475
No. 1 Morse Universal Grinder, new	1275
No. 2 Morse Universal Grinder, new	1650
No. 2 Brown & Sharpe Universal Grinder, old type	375
12—12-in.x5-ft. Hendey Yokehead Lathes, oilpan bed, taper attachment, draw bar, chuck	775
12-in.x9-ft. Hendey Lathe, motor dr.	
2—14-in.x6-ft. Hendey Yokehead Lathes, standard equipment	875
14-in.x8-ft. Hendey Lathe, motor dr.	
2—16-in.x7-ft. Hendey Yokehead Lathes, taper atachment	825
18-in.x10-ft. Hendey Yokehead Lath, standard equipment	1100
20-in.x8-ft. LeBlond Heavy Duty Engine Lathe	825
24-in.x12-ft. LeBlond Heavy Duty Lathe, taper attachment	1100
24-in.x12-ft. Reed Engine Lathe, taper attachment	1175
No. 2 Cincinnati High Power Plain Miller	1850
No. 2 Rockford Heavy Duty Plain Miller, Dividing Heads	975
No. 1 Brown & Sharpe Plain Miller, open belt	700
No. 1½ Hendey Plain Miller, open belt	650
No. 1½ Brown & Sharpe Plain Miller, backgeared	800
6—No. 12 Brown & Sharpe Manufacturing Millers, Serials 1900	575
No. 8 Hendey Duplex Millers	1200
No. 3 LeBlond Universal Miller, regular equipment	1450
No. 3 Brown & Sharpe Universal Miller, plain heads	900
No. 2M Cincinnati Allgeared Universal Miller	2250
No. 2 Cincinnati High Power Universal Miller	2700
No. 2A Hendey Universal Miller, single pulley drive	1250
No. 2 Hendey Universal Miller, all power feeds	1150
No. 2 Cincinnati Vertical Miller, threaded nose	750
No. 2 Brown & Sharpe Vertical Miller, excellent condition	900
1½x18-in. Pratt & Whitney Turret Lathe, excellent condition	425
2½x26-in. Pratt & Whitney Turret Lathe, collets	775
2½x26-in. Pratt & Whitney Turret Lathe, brand new	1475
No. 6 Brown & Sharpe Turret Lathe, all power feeds.	
No. 4 Brown & Sharpe Turret Lathe.	
No. 2 Brown & Sharpe Turret Lathe.	
18-in. Libby Turret Lathe, like new	3300
5—No. 2A Warner & Swasey Turret Lathes, Serials 114000	1850
3—No. 2 Southworth Turret Lathes	375
4—No. 4 Warner & Swasey Turret Lathes	350
16-in. Stockbridge Crank Shaper, power down feed	475
3—No. 2 Manville Thread Rollers	375
3—No. 2 Manville Screw Slotters	350
3—No. 0 Waterbury Farrel Screw Slotters	425
2—No. 20 Waterbury Farrel Thread Rollers	775
No. 4 Manville Hand Feed Thread Roller	750
No. 1½ Bliss D. A. Cam Press	650
No. 3½ Bliss D. A. Toggle Press	900
36-in. Flather Gear Cutter	

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Drills, 26 in. and 32 in. Hoefer sliding head
Drill, 25 in. Kokomo, high speed
Grinders, 6 x 15 in. Fitchburg, 10 x 20 in. Landis
Grinder, 12 in. x 36 in. Cincinnati universal
Lathes 21 in. x 10 ft. LeBlond, heavy duty
Lathe, 18 in. x 10 ft. American quick change
Miller, Bilton No. 25, Plain
Miller, No. 2 Brown & Sharpe, heavy
Millers, No. 2 and No. 3 Kempsmith plain
Pipe Machine, 2, 4, and 6 in.
Presses, Nos. 1, 1½, 2 and 4 Robinson
Presses, New O.B.I. at low prices
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Shaper, 24 in. Rockford back geared
Shear, 5 ft. Robinson No. 362
Shear, No. 562 Niagara
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Columbus, Ohio (1)

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No. 3 **American** Rack Type.
No. 3 **Lapointe** (Hudson).
No. 3 **Lapointe** (Hud.) 2 Spindle.
No. 4 **Lapointe** (Hudson).

MILES MACHINERY CO.
Saginaw W. S., Mich.

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Continued from page 110

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2—Kempsmith No. 33 Lincoln Type Production.
1—Pratt & Whitney 4½-in.x12-in. Thread Millers.
10—Brown & Sharpe and Hendey Universal Millers.
20—Pratt & Whitney 5-in. Automatic.
73—Lincoln Type Millers.
12—Brown & Sharpe No. 12 Plain.
1—Cincinnati No. 2 Plain.

LATHES

4—Hendey 14-in.x6-ft. Q.C.G. Yoke Head.
1—Hendey 16-in.x8-ft. Q.C.G. Yoke Head.
4—Monarch 14-in.x6-ft. Q.C.G. Engine Lathes.
1—Monarch 28-in.x10-ft. Q.C.G. Engine Lathe.
1—LeBlond 19-in.x10-ft. Q.C.G. Heavy Duty.
1—McCabe 26-in.x44-in.x14-ft. (2 in 1) L.C.G.
1—Porter 16-in.x10-in. Q. C. G. (new).
12—Precision Bench Lathes.
6—Porter Cable Production.
1—Wickes 32x12 Heavy Duty.

SCREW MACHINES

12—National Acme No. 56 2¼-in. Cap. 4 spdle. Auto.
4—New Britain No. 23 and 33 Automatic Chucking.
12—Garvin No. 2½ S.G. Hand Screw Machines.
15—Gridley 1¼-in. Auto 4 SP.
1—No. 4 W. & S. Univ. Geared Head.
3—Jones & Lamson 3-in.x36-in. Flat Turret Lathes.
1—Gisholt 24-in. Type "T" Turret Lathe.
1—Libby 22-in. Turret Lathe.
4—Potter & Johnston No. 6A—17,000 Serials.
3—Cleveland Model "C" Automatics, ⅞-in.-1¼-in. cap., Serial Nos. over 30,000.

DRILL PRESSES

2—Natco No. 37 Multiple Spdle. Drills.
3—Pratt & Whitney No. 13 Multiple Spdle. Drills.
1—Natco 18-in. Motor Driven Heavy Duty Drill Press.
1—Henry & Wright Class B 12-in. overhang 3 spdle.
3—Leland-Gifford 12-in. Sgle. Spdle. Drill Presses.
1—Colburn D4 24-in. Sgle. Spdle. Heavy Duty Drill.
3—Avey No. 2 Ball Bearing Sens.

Special Low Price

14—HARTFORD ¾-in. capacity Automatic Screw Machines with Reciprocating Spindle Head and Single Tool-Holding Spindle (Like Cut).

Maximum Chuck capacity ..... ¾ inch
Length that can be turned..... ⅝ inch
Floor space .....2 ft. 9-in. x 1-ft. 6-in.
Weight with countershaft .....440 pounds
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PRICE $100.00 Ea.

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1—Blanchard No. 16 Motor Driven Vertical.
1—Heald No. 72 Sizematic.
3—Heald No. 70 Internal (Clutch in head type).
1—Landis 16-in.x52-in. Plain Cyl.
4—Brown & Sharpe No. 2 Surface.
3—Heim Centerless Grinders (Motor Drive).

GEAR CUTTERS

2—Barber-Colman No. 2 Gear Hobbers.
2—Gould & Eberhardt No. 18HM, 2 SP., Gear Hobbers.
1—Gleason 24-in. Bevel Gear Planer.
6—H. Pfauter Gear Hobbers.
4—Brown & Sharpe No. 3-26-in. Automatic.

SHAPERS

2—Potter & Johnston 15-in. Universal Crank Shapers.
1—Milwaukee 16-in. Crank Shaper.
1—Gould & Eberhardt 16-in. B.G. Crank Shaper.
1—Hendey 20-in. B.G. Crank Shaper.
3—Gould & Eberhardt 14-in. High Duty Crank.
1—American 15-in. Universal Crank Shaper.

POWER PRESSES

25—Bliss No. 18-19 and 20 Inclinable Presses.
10—Bliss No. 1, 2, 3 and 4 "Stiles" Type Presses.
5—V&O No. 2½ Inclinable Power Presses.
2—Zeh & Hahnemann No. 5 Inclinable Presses.
15—Farrel Presses (Various Sizes).
1—Waterbury-Farrel No. 6 Geared Double Action Pillar Cam Press.
150—Bench Foot Presses.
2—Lucas 15-ton Power Forcing Presses.

MISCELLANEOUS

1—Oven Equipment Co. Automatic Feed Japanning Oven 12-ft. long.
1—Betts 10-in. Stroke Crank Slotter.
1—Standard No. 3 300 lb. Automatic Belt Drop Hammer.
1—Manville No. 1 Double Stroke Open Die Motor Driven Header.
1—Gorton No. 1D Motor Driven Engraving Machine.
1—2-Ton Shepard Electric Crane with 60-ft. Span.
1—Whitcomb 24x24x6 Planer, Second Belt Drive.
1—Whitcomb 30x30x12 Planer, Second Belt Drive.
2—New Haven 36-in.x46-in. Model "A" Self Contained Sand Blast Barrels.

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72-in. Colburn, 2 heads, rapid traverse.
60-in. Gisholt, 2 heads, rapid traverse.
60-in. Colburn, 2 heads, rapid traverse.
42-in. King, 2 heads, rapid traverse.
42-in. King, 2 heads.
42-in. Bullard, 2 heads.
42-in. Colburn, 1 turret head.
36-in. Colburn, 1 turret head, rapid traverse.
36-in. Gisholt, turret head, rapid traverse.
24-in. Bullard, side head, New Era type.
36-in. Bullard, side head, New Era type.
38-in., 44-in. Niles, side head.

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All Single Pulley Driven

No. 1½ A Milwaukee. Range 28 in. x 19 in. x 10 in.
No. 2 Cincinnati. Range 28 in. x 19 in. x 10 in.
No. 2B Heavy Brown & Sharpe, 28 in. x 19 in. x 8 in.
No. 4 Cincinnati. Range 54 in. x 14 in. x 20 in.

MILES MACHINERY CO.
Saginaw W. S., Mich.

Hobbing Machines

5—Lees-Bradner's No. 5-A.
Serial 205.....$600.00
Serial 175 Rebuilt..... 600.00
Serial 188..... 400.00
Serial 179..... 400.00
Serial 813 ..... 400.00

Price f.o.b. Cleveland, O.

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Cleveland, O.

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For Alphabetical Index See Last Page

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Norton Co., Worcester, Mass.

AFTER Coolers, Air
Chicago Pneumatic Tool Co., N.Y.C.

AGITATORS, Quenching Tank
Rockwell Co., S. P., Hartford

AIR Receivers
Chicago Pneumatic Tool Co., N.Y.C.

ALLOYS, Special
Timken Roller Bearing Co., Canton, O.

ANGLE Plates
U. S. Auto. Box Mchy. Co., Newtonville-Boston

ANODES, Electroplating, all Metals
Hanson-Van Winkle-Munning Co., Matawan, N. J.

ARBORS
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Sundstrand Mach. Tool Co., Rockford, Ill.
Union Twist Drill Co., Athol, Mass.
Westcott Chuck Co., Oneida, N. Y.

BALANCING Machines
Olsen, Tinius Test. Mach. Co., Philadelphia

BALANCING Ways
Anderson Bros. Mfg. Co., Rockford, Ill.
Sundstrand Mach. Tool Co., Rockford, Ill.

BALL Retainers
New Departure Mfg. Co., Bristol, Conn.

BALLS, Brass, Bronze & Steel
Auburn Ball Bearing Co., Rochester.
Hartford Steel Ball Co., Hartford.
Hoover Steel Ball Co., Ann Arbor
New Departure Mfg. Co., Bristol.
S. K. F. Industries, N. Y. C.

BARRELS, Burnishing & Tumbling
Hartford Steel Ball Co., Hartford.

BARS, Boring
Davis Boring Tool Co., St. Louis

BARS, Boring, Expansion
Davis Boring Tool Co., St. Louis

BARRELS, Plating
Hanson-Van Winkle-Munning Co., Matawan, N. J.

BEARINGS, Ball
Auburn Ball Bearing Co., Rochester.
Bantam Ball Bearing Co., South Bend, Ind.
New Departure Mfg. Co., Bristol.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S. K. F. Industries, N. Y. C.
Torrington (Conn.) Co.

BEARINGS, Die Cast
Milwaukee (Wis.) Die Casting Co.
Stewart Die Casting Corp., Chicago

BEARINGS, Journal
S. K. F. Industries, N. Y. C.
Timken Roller Bearing Co., Canton

BEARINGS, Roller
Bantam Ball Bearing Co., South Bend, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S. K. F. Industries, N. Y. C.
Timken Roller Bearing Co., Canton

BEARINGS, Thrust
S. K. F. Industries, N. Y. C.
Timken Roller Bearing Co., Canton, O.

BELT Clamps
Dodge Mfg. Corp., Mishawaka, Ind.

BELT Fasteners
Bristol Co., Waterbury, Conn.

BELT Shifters
Dodge Mfg. Corp., Mishawaka, Ind.
Haskins Co., R. G., Chicago

BELTING, Chain
(See Chain Driving)

BELTING, Conveyor
Wickwire-Spencer Steel Corp., N.Y.C.

BENCH Legs
New Britain-Gridley Mach. Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING Machines, Power
Buffalo (N.Y.) Forge Co.
Cincinnati (O.) Shaper Co.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Wickes Bros., Saginaw, Mich.

BENDING and Straightening Mchs.
Cincinnati (O.) Shaper Co.
Elmes Eng. Wks., Chas. F., Chicago
Pels & Co., Henry, N. Y.
Watson-Stillman Co., N. Y.

BITS, Tool
(See Tool Bits)

BLOCKS, Chain
(See Hoists, Hand)

BLOCKS, Pillow
Dodge Mfg. Corp., Mishawaka, Ind.
S. K. F. Industries, N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.

BLOWERS
American Gas Furnace Co., Elizabeth, N. J.
Buffalo (N. Y.) Forge Co.
General Electric Co., Schenectady

BLUE Printing Machinery
Wickes Bros., Saginaw, Mich.

BOLT and Nut Machinery
Acme Mchy. Co., Cleveland
Foote-Burt Co., Cleveland
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland
National Machinery Co., Tiffin, O.

BOLT Threading Machines
Greenfield (Mass.) Tap & Die Corp.

BOLTS and Nuts
National Acme Co., Cleveland

BOOKS, Technical
McGraw-Hill Book Co., N. Y.

BORING and Turning Mills, Vertical
Bullard Co., Bridgeport, Conn.
Cincinnati (O.) Planer Co.
Sellers & Co., Wm., Philadelphia

BORING, Drilling and Milling Machines Horizontal
Barnes Co., W. F. & John, Rockford, Ill.
Defiance (O. Machine Works
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Lucas Mach. Tool Co., Cleveland
Moline (Ill.) Tool Co.
Rockford (Ill.) Drilling Mach. Co.
Sellers & Co., Wm., Philadelphia
Springfield (O.) Mch. Tool Co.

BORING, Drilling and Milling Machines, Vertical
Ferner Co., R. Y., Washington
Universal Boring Machine Co., Hudson, Mass.

BORING, Heads
Casler Herman, Canasota, N. Y.
Davis Boring Tool Co., St. Louis

BORING Machines, Car Wheel
Manning, Maxwell & Moore, Inc., N. Y.
Sellers & Co., Wm., Philadelphia

BORING Machines, Locomotive Driving Box
Sellers & Co., Wm., Philadelphia

BORING Tools
Armstrong Bros. Tool Co., Chicago
Davis Boring Tool Co., St. Louis
Eclipse Counterbore Co., Detroit
Prosser & Son, Thos., N. Y.

BRAKES, Electric Magnetic
Cutler-Hammer, Milwaukee

BROACH Grinders
LaPointe Mach. Tool Co., Hudson, Mass.

BROACHES
Lapointe Mach. Tool Co., Hudson, Mass.
Perkins Machine & Gear Co., Springfield, Mass.

BROACHING Machines
Lapointe Mach. Tool Co., Hudson, Mass.

BRUSHES, Industrial
Hanson-Van Winkle-Munning Co., Matawan, N. J.

BUCKET Carriers, Pivoted
Link-Belt Co., Chicago

BUFFING & Polishing Machines
(See Polishing & Buffing Machines)

BUFFS
Hanson-Van Winkle-Munning Co., Matawan, N. J.

BURNERS, Oil and Gas
Johnson Gas Appliance Co., Cedar Rapids, Iowa

BUSHINGS
Ex-Cell-O Aircraft & Tool Corp. Detroit
Universal Engineering Co., Frankenmuth, Mich.

BUSHINGS, Drill and Jig
Acme Industrial Co., Chicago
Ex-Cell-O Aircraft & Tool Corp., Detroit
Universal Engineering Co., Frankenmuth, Mich.

CABLE, Insulated
Simplex Wire & Cable Co., Boston

CABINETS, Tool, Reamer & Drill, Steel
(See Furniture, Machine Shop)

CALIPERS
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

CAM Cutting Machines
Rowbottom Mach. Co., Waterbury.

CAMS
Hartford (Conn.) Special Machy. Co.
Rowbottom Mach. Co., Waterbury.

CARBONIZING Machines
American Gas Furnace Co., Elizabeth, N. J.

CASE Hardening and Tempering Compound
Meisel Press Mfg. Co., Boston
Shore Instrument & Mfg. Co., Jamaica, N. Y.

CASTINGS, Aluminum
Harsch Bronze & Fdry. Co., John, Cleveland
Stewart Die Casting Corp., Chicago

CASTINGS Brass, Bronze & Copper
Harsch Bronze & Fdry. Co., John, Cleveland
Milwaukee (Wis.) Die Casting Co.
Stewart Die Casting Corp., Chicago

CASTINGS, Die Molded
Harsch Bronze & Fdry. Co., John, Cleveland

CASTINGS, Iron and Steel
Etna Machine Co., Toledo
Franklin Mach. Co., Providence.
Link-Belt Co., Chicago
Manning, Maxwell & Moore, Inc., N. Y.
Producto Machine Co., Bridgeport
Springfield (O.) Mach. Tool Co.

CASTINGS, Semi-Steel
Springfield (O.) Machine Tool Co.

CENTERING Machines
Hanson-Whitney Machine Co., Hartford
Pratt & Whitney Co., Hartford
Sundstrand Mach. Tool Co., Rockford, Ill.
Whiton Mach. Co., D. E., New London, Conn.

CENTERS, Adjustable
Eclipse Counterbore Co., Detroit

CENTERS, Lathe
Nielsen Inc., Lawton, Mich.

CENTERS, Planer
Cincinnati (O.) Planer Co.

CHAINS
(See Sprockets & Chains)

CHAINS, Driving
Boston Gear Works Sales Co., Quincy, Mass.
Link-Belt Co., Chicago
Philadelphia (Pa.) Gear Wks.
Whitney Mfg. Co., Hartford, Conn.

CHECKS, Metal Trim and Tool
Noble & Westbrook Mfg. Co., Hartford

CHUCKING Machines
Bullard Co., Bridgeport, Conn.
Cleveland (O.) Auto. Mach. Co.
Goss & deLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Cleveland
New Britain-Gridley Mach. Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland

CHUCKS, Air Operated
Logansport (Ind.) Machine Co.

CHUCKS, Automatic and Quick Changing
Errington Mech. Laboratory, S. I. N. Y.
Geometric Tool Co., New Haven.
Jarvis Co., Charles L., Gildersleeve, Conn.
Modern Tool Works, Rochester
National Tool Co., Cleveland
Scully-Jones & Co., Chicago
Titan Tool Co., Erie, Pa.

CHUCKS, Centering
Cushman Chuck Co., Hartford
Westcott Chuck Co., Oneida, N. Y.

CHUCKS, Collet
Logansport (Ind.) Machine Co.
Sundstrand Mach. Tool Co., Rockford, Ill.
Titan Tool Co., Erie, Pa.

CHUCKS, Drill and Tap
Cushman Chuck Co., Hartford
Errington Mech. Lab., S. I., N. Y.
Jarvis Co., Chas. L., Gildersleeve, Conn.
Scully-Jones & Co., Chicago
Titan Tool Co., Erie, Pa.
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

CHUCKS, Full Floating
Errington Mech. Laboratory, S. I. N. Y.

CHUCKS, Lathe
Bullard Co., Bridgeport, Conn.
Casler, Herman, Canasota, N. Y.
Cushman Chuck Co., Hartford
Westcott Chuck Co., Oneida, N. Y.
Whiton Mach. Co., D. E., New London, Conn.

CHUCKS, Magnetic
Heald Machine Co., Worcester, Mass.
Walker Co., O. S., Worcester, Mass.

CHUCKS, Planer
Cincinnati (O.) Planer Co.

CHUCKS, Split
Seneca Falls (N. Y.) Machine Co
Stark Tool Co., Waltham, Mass.

CHUCKS, Vertical Boring Mill
Bullard Co., Bridgeport.
Whiton Machine Co., D. E., New London, Conn.

CLAMPS, Machinists'
Armstrong Bros. Tool Co. Chicago
Starrett Co., L. S., Athol, Mass.

CLEANERS, Metal, Waste General
Oakite Products, Inc., N. Y.

CLEANING Machines, Metal Parts
Colts Patent Fire Arms Mfg. Co., Hartford

CLUTCHES, Friction
Brown Eng. Co., Reading, Pa.
Cutler-Hammer Mfg. Co., Milwaukee
Dodge Mfg. Corp., Mishawaka, Ind.
Foote Bros. Gear & Mach. Co., Chicago
Johnson Machine Co., Carlyle, Manchester, Conn.
Jones Fdry. & Machine Co., W. A. Chicago
Link-Belt Co., Chicago
Oesterlein Mach. Co., Cincinnati
Raybestos Manhattan, Inc., Bridgeport

COAL & ASH Handling Machinery
Link-Belt Co., Chicago

COAL Storage Systems
Link-Belt Co., Chicago

COLLARS, Shaft or Set
Dodge Mfg. Corp., Mishawaka, Ind.

COLLARS, Spacing
Detroit (Mich.) Stamping Co.
Scully-Jones & Co., Chicago

COLLETS
Brown & Sharpe Mfg. Co., Providence
Geometric Tool Co., New Haven.
Rivett Lathe & Grinder Corp., Boston
Union Twist Drill Co., Athol, Mass
Whitney Mfg. Co., Hartford, Conn.

COMPOUNDS, Buffing and Polishing
Hanson-Van Winkle-Munning Co., Matawan, N. J.

COMPOUNDS, Cleaning
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Oakite Products, N. Y.
Wayne Soap Co., Detroit

COMPOUNDS, Cutting, Drawing Grinding and Screw Cutting
Oakite Products, N. Y.
Wayne Soap Co., Detroit

COMPOUNDS, Resin
Bakelite Corp., N. Y. C.

COMPRESSORS, Air and Gas
Chicago Pneumatic Tool Co., N.Y.C.
General Electric Co., Schenectady

SIMONDS BLADES ARE TEMPERED FOR TOUGH METAL CUTTING

PRODUCTION and lasting quality are essentials which go far to establish the SIMONDS HARD EDGE BAND SAW at the head of its type in the metal cutting field. It has been proved over and over that during a given period SIMONDS HARD EDGE BANDS give greater average cutting life with faster average cutting time than any other blade made.

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New Orleans, La.			

SIMONDS HARD EDGE METAL BAND SAWS

CONDUITS, Interior
General Electric Co., Schenectady

CONTRACT Work
American Metal Treatment Co., Elizabeth, N. J.
American Tool & Gauge Co., Cleveland
Brinton Co, H., Philadelphia
Brown & Sharpe Mfg. Co., Providence
Columbus (O.) Die T. & M. Co.
Detroit (Mich.) Stamping Co.
Franklin Machine Co., Providence
Hamilton Tool Co., Hamilton, O.
Hartford (Conn.) Special Machy. Co.
Hertzler & Zook Co., Belleville, Pa.
Hoenes Eng'r'ing Service, Cleveland
Kline Hdw. Co., Allentown, Pa.
Krasberg Tool & Mfg. Co., Chicago
Langelier Mfg. Co., Providence
Lincoln Mach. Co., Pawtucket, R. I.
Mechanical Eng'r'ing Serv. Corp., Detroit
Meisel Press Mfg. Co., Boston
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Oxweld Acetylene Co., Long Island City
Precision Engr. Co., Phila.
Producto Machine Co., Bridgeport, Conn.
Root Co., B. M., York, Pa.
U. S. Tool Co., Ampere, N. J.
Waltham (Mass.) Mach. Wks.

CONTROLLERS & Starters, Electric
Cutler-Hammer Mfg. Co., Milwaukee
General Electric Co., Schenectady

CONVERTORS
General Electric Co., Schenectady

CONVEYORS
Dodge Mfg. Corp., Mishawaka, Ind.
Link-Belt Co., Chicago

COUNTERBORES
Cleveland (O.) Twist Drill Co.
National Tool Co., Cleveland
Scully-Jones & Co., Chicago

COUNTERS, Revolution
Bristol Co., Waterbury, Conn.
Veeder-Root, Hartford

COUNTERSHAFTS
Dodge Mfg. Corp., Mishawaka, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
American Swiss File & Tool Co., Elizabeth, N. J.
Greenfield (Mass.) Tap & Die Corp.

COUNTING Machines
Veeder-Root, Hartford
White Dental Mfg. Co., S. S., New York, N. Y.

COUPLINGS, Flexible
Boston Gear Works Sales Co., Quincy, Mass.
Brown Eng. Co., Reading, Pa.
Foote Bros. Gear & Mach. Co., Chicago
Jones Fdry. & Machine Co., W. A., Chicago
Morrison Mach. Co., Paterson, N. J.
Nicholson & Co., W. H., Wilkes-Barre
Philadelphia (Pa.) Gear Wks.

COUPLINGS, Hose, Universal
Chicago Pneumatic Tool Co., N.Y.C.

COUPLINGS, Shaft
Johnson Mach. Co. Carlyle, Manchester, Conn.
Link-Belt Co., Chicago
Morrison Mach. Co., Paterson, N. J.

CRANES, Gantry
Manning, Maxwell & Moore, Inc., N. Y.

CRANES, Locomotive & Crawler
Link-Belt Co., Chicago

CRANKSHAFT-Lapping Machines
Norton Co., Worcester, Mass.

CRAYONS, Metal Workers
Cohutta Talc Co., Dalton, Ga.

CUT-OUTS, Electric
General Electric Co., Schenectady

CUTTERS, Gear
Brown & Sharpe Mfg. Co., Providence
National Twist D. & T. Co., Detroit
O. K. Tool Co., Shelton, Conn.
Union Twist Drill Co., Athol, Mass.

CUTTERS, Keyseater
Davis Keyseater Co., Rochester

CUTTERS, Milling
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence
Butterfield & Co., Derby Line, Vt.
Geometric Tool Co., New Haven, Conn.
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Modern Tool Works, Rochester
National Twist D. & T. Co., Detroit
O. K. Tool Co., Shelton, Conn.
Pratt & Whitney Co., Hartford
Producto M. . Bridgeport, Conn.
Scully-Jones & Co., Chicago
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

CUTTING Apparatus, Oxyacetylene
Oxweld Acetylene Co., Long Island City

CUTTING-OFF Machines
Brown & Sharpe Mfg. Co., Providence
Etna Machine Co., Toledo, O.
Gorton Mach. Co., Geo. , Racine, Wis.
Landis Mach. Co., Waynesboro, Pa.

CUTTING-OFF Tools
Armstrong Bros. Tool Co., Chicago
Prosser & Son, Thos., N. Y.

CUTTING Oil Disinfectants
Sulpho-Napthol Co., Boston

DEALERS, Machinery
(See Searchlight Section)
Botwinik Bros., New Haven
Brownell Machy. Co., Providence
Cleveland (O.) Hobbing Mach. Co.
Delta Equipment Co., Philadelphia
Emerman & Co., L. E., Chicago
Essley Mchy. Co., E. L., Chicago
General Mchy. Corp., Boston
Hill, Clarke & Co., Chicago
Hyman & Sons, J., Phila.
Lucas & Son, J. L., Bridgeport
Miles Machy. Co., Saginaw
Morey & Co., Inc., N. Y. C.
Osborne & Sexton Mchy. Co.
Simmons Machine Tool Co., Albany

DEMAGNETIZERS
Walker Co., O. S., Worcester, Mass.

DIAMOND Tools
Desmond-Stephan Mfg. Co. Urbana, O.
Dickinson, Thomas L., N. Y.

DIE Cutting Machines, Auto.
Keller Mech. Engr. Corp., Brooklyn

Die Holders for Presses
Producto Machine Co., Bridgeport, U. S. Tool Co., Ampere, N. J.

DIE Makers Supplies
Danly Mach. Spec., Inc., Chicago

DIEING Machines
Henry & Wright Mfg. Co., Hartford

DIE Making Machines
Haskins Co., R. G., Chicago
Keller Mech. Engr. Corp., Brooklyn
Reed-Prentice Corp., Worcester
White Dental Mfg. Co., S. S., New York, N. Y.

DIE Sets
Baumbach Mfg. Co., E. A., Chicago
Danly Mach. Spec., Inc., Chicago

DIES, Adjustable, Self Opening
Eastern Mach. S. Corp., New Haven
Errington Mech. Laboratory, S. I. N. Y.
Geometric Tool Co., New Haven.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro, Pa.
Modern Tool Works, Rochester
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Machy. Co., Tiffin, O.

DIES, Forging
Butterfield & Co., Derby Line, Vt.
Keller Mech. Engr. Corp., Brooklyn

DIES, Sheet and Sub Press
(See Contract Work)

DIES, Steel Marking
Noble & Westbrook Mfg. Co., Hartford

DISINFECTANTS
Sulpho-Napthol Co., Boston

DIVIDING Heads
Carl Zeiss, (Geo. Scherr Co.), N. Y.
U. S. Mach. Tool Co., Cincinnati

DOGS, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago

DRAFTING Materials
American Pencil Co., Hoboken

DRESSERS, Grinding Wheel
Bay State Stamp Co., Worcester
Desmond-Stephan Mfg. Co. Urbana, O.
Norton Co., Worcester, Mass.

DRILL Holders
Armstrong Bros. Tool Co., Chicago

DRILL Speeders
Graham Mfg. Co., Providence

DRILL and Tap Heads, Multiple
Errington Mech. Laboratory, S. I. N. Y.
Hoefer Mfg. Co., Freeport, Ill.

DRILLING Machine Heads
Rockford (Ill.) Drilling Machine Co
U. S. Drill Head Co., Cincinnati

DRILLING Machines, Automatic
Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Detroit (Mich.) Machine Tool Co.
Rockford (Ill.) Drilling Machine Co
Sundstrand Mach. Tool Co., Rockford, Ill.

DRILLING Machines, Bench
Ames Co., B. C., Waltham, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Clark Electric Co., Jas., Jr., Louisville, Ky.
Rockford (Ill.) Drilling Mach. Co
Thompson Mfg. Co., So. Easton, Mass.

DRILLING Machines, Electric & Pneumatic
Chicago Pneumatic Tool Co., N.Y.C.

DRILLING Machines, Gang
Baker Bros., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Henry & Wright Mfg. Co., Hartford
Rockford (Ill.) Drilling Machine Co.

DRILLING Machines, Heavy Duty
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Inc., Rockford, Ill.
Bradford Mach. Tool Co., Cincinnati
Foote-Burt Co., Cleveland
Minster Machine Co., Minster, O.
Rockford (Ill.) Drilling Machine Co

DRILLING Machines, Horizontal
(See Boring, Drilling & Milling Machines, Horizontal)
Baker Bros., Toledo
Bradford Mach. Tool Co., Cincinnati
Detroit (Mich.) Machine Tool Co.

DRILLING Machines, Multiple Spindle
Baker Bros., Toledo, O.
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Detroit (Mich.) Machine Tool Co.
Foote-Burt Co., Cleveland
Grant Mfg. & Mach. Co., Bridgeport
Henry & Wright Mfg. Co., Hartford
Kingsbury Mach. Tool Corp., Keene, N. H.
Manning, Maxwell & Moore, Inc., N. Y.
Moline (Ill.) Tool Co.
Pratt & Whitney Co., Hartford
Rockford (Ill.) Drilling Mach. Co.
Sellers & Co., Wm., Philadelphia

DRILLING Machines, Radial
American Tool Wks. Co., Cincinnati
Carlton Machine Tool Co., Cincinnati
Cincinnati (O.) Bickford Tool Co.
Morris Mach. Tool Co., Cincinnati
Sellers & Co., Wm., Philadelphia

DRILLING Machines, Semi-Automatic
Bradford Mach. Tool Co., Cincinnati
Detroit (Mich.) Machine Tool Co.

DRILLING Machines, Sensitive
Barnes Co., W. F. & John, Rockford, Ill.
Buffalo (N. Y.) Forge Co.
Hardinge Brothers, Chicago
Henry & Wright Mfg. Co., Hartford
High Speed Hammer Co., Rochester.
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Taylor & Fenn Co., Hartford, Conn.
Thompson Mfg. Co., So. Easton, Mass.
U. S. Mch. Tool Co., Cincinnati

DRILLING Machines, Vertical
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Inc., Rockford, Ill.
Bradford Mach. Tool Co., Cincinnati
Cincinnati (O.) Bickford Tool Co
Foote-Burt Co., Cleveland
Henry & Wright Mfg. Co., Hartford
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Manning, Maxwell & Moore, Inc., N. Y.
Oesterlein Mach. Co., Cincinnati
Rockford (Ill.) Drilling Mach. Co.
Superior Mach. Tool Co., Kokomo, Ind.

DRILLS
Ampco Twist Drill Co., Jackson, Mich.

DRILLS, Center
Cleveland (O.) Twist Drill Co.
Union Twist Drill Co., Athol, Mass

DRILLS, Core
Eclipse Counterbore Co., Detroit

DRILLS, Portable, Elec. and Pneumatic
Buckeye Portable Tool Co., Dayton
Chicago Pneumatic Tool Co., N.Y.C.
Clark Electric Co., Jas., Jr., Louisville, Ky.
Standard Elect. Tool Co., Cincinnati
White Dental Mfg. Co., S. S., New York, N. Y.

DRILLS, Ratchet
Armstrong Bros. Tool Co., Chicago
Union Twist Drill Co., Athol, Mass.

DRILLS, Twist and Flat
Bay State Tap & Die Co., Mansfield, Mass.
Butterfield & Co., Derby Line, Vt.
Cleveland (O.) Twist Drill Co.
Greenfield (Mass.) Tap & Die Corp.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

DRYING Machines, Metal Parts
Colts Patent Fire Arms Mfg. Co., Hartford

ELECTRICAL Instruments
General Electric Co., Schenectady

ELECTRICAL Supplies
Cutler-Hammer Mfg. Co., Milwaukee
General Electric Co., Schenectady
Simplex Wire & Cable Co., Boston

ELEVATORS & Conveyors
Dodge Mfg. Corp., Mishawaka, Ind.
Link-Belt Co., Chicago

ELEVATOR Trucks
(See Trucks)

ENAMELS
Du Pont de Ne Mours & Co., E. I., Wilmington

ENGINES, Oil, Gas & Steam
Chicago Pneumatic Tool Co., N.Y.C.

ENGRAVING Machinery
Gorton Mach. Co., Geo., Racine, Wis.

EXTRACTORS Oil
Barrett Leon J., Worcester, Mass

FACING Machines
Preis & Co. H. P., Newark, N. J.

FANS, Electric
Buffalo (N.Y.) Forge Co.
General Electric Co., Schenectady

FILES, Precision
American Swiss File & Tool Co., Elizabeth, N. J.

FILES & Rasps
Grobet File Corp. of Amer., N. Y. C.
Simonds Saw & Steel Co., Fitchburg, Mass.

FILING Machines
Ames Co., B. C., Waltham, Mass.
Haskins Co., R. G., Chicago
Oliver Instrument Co., Adrian, Mich.
White Dental Mfg. Co., S. S., New York, N. Y.

FILLER, Iron
(See Cements, Iron)

FILTERS, Oil
(See Oil Filtering)

FITTINGS, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

FLEXIBLE Shaft Equipment
Keller Mech. Engr. Corp., Brooklyn
Strand & Co., N. A., Chicago
White Dental Mfg. Co., S. S., New York, N. Y.

FLUX, Solder
Wayne Soap Co., Detroit

FORGING Machinery
Acme Mchy. Co., Cleveland
National Mchy. Co., Tiffin, O.

FORGINGS, Drop
Gears & Forgings, Inc., Cleveland

FORGINGS, Flat Die
Gears and Forgings, Inc., Cleveland

FORGINGS, Weldless Rings
Gears and Forgings, Inc., Cleveland

FURNACES, Electric
Electric Furnace Co., Salem, O.

FURNACES, Forging
American Electric Furnace Co., Boston
American Gas Furnace Co., Elizabeth, N. J.
Strong, Carlisle & Hammond Co., Cleveland

FURNACES, Heat Treating, Tempering and Annealing
American Electric Furnace Co., Boston
American Gas Furnace Co., Elizabeth, N. J.
Electric Furnace Co., Salem, O.
General Electric Co., Schenectady
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Strong Carlisle & Hammond Co Cleveland

FURNACES, Oil & Gas
Johnson Gas Appliance Co., Cedar Rapids, Iowa
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Co., Toledo

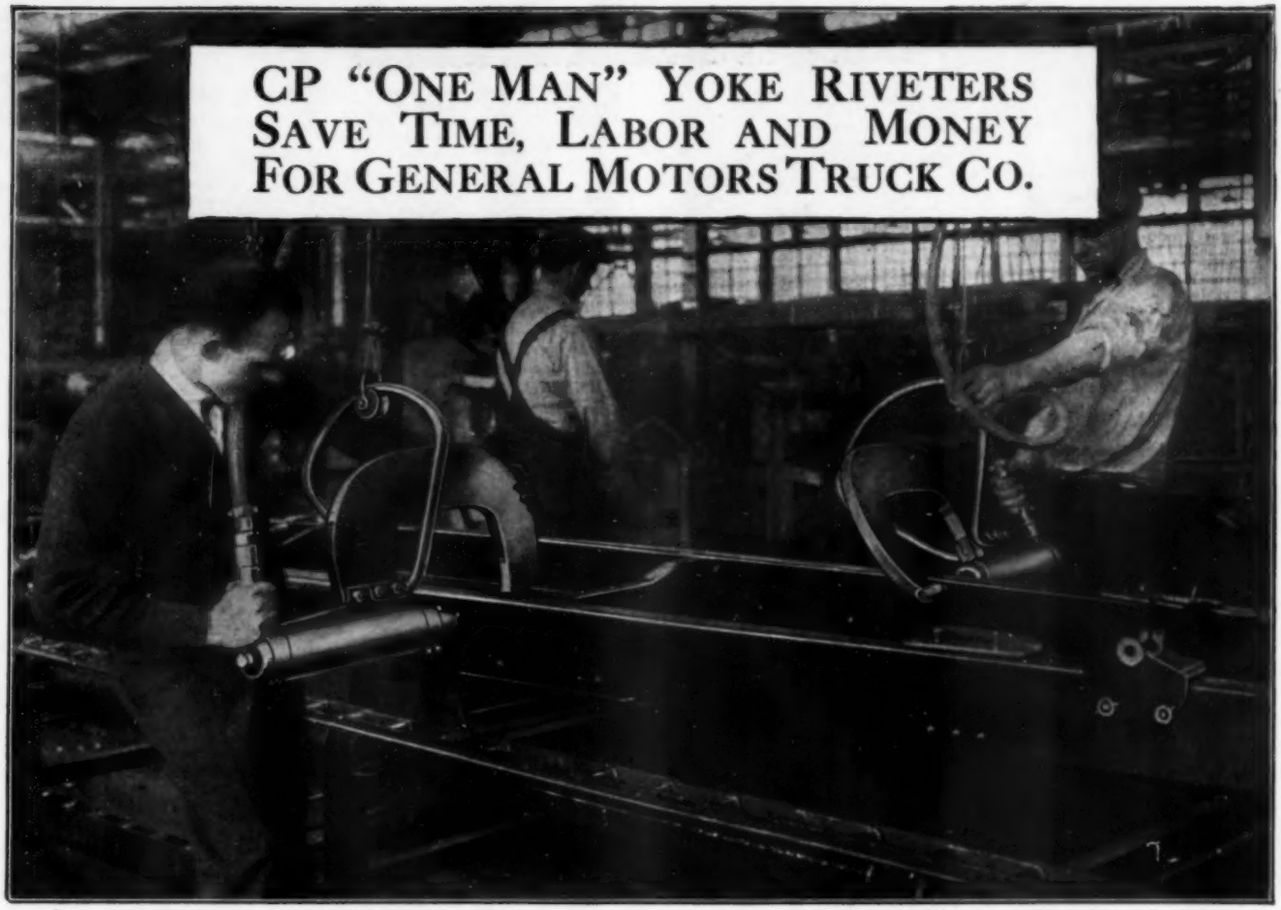
FURNITURE, Machine Shop
Brown Eng. Co., Reading, Pa.
New Britain-Gridley Mach. Co., New Britain, Conn.

GAGE Blocks
Standard Gage Co., Inc., Poughkeepsie, N. Y.

GAGES, Comparators
Federal Products Corp., Providence
Jones & Lamson Mch. Co., Springfield, Vt.

GAGES, Dial
Ames, Co., B. C., Waltham, Mass.
Federal Products Corp., Providence
Lowe, Henry A., Cleveland
Standard Gage Co., Inc., Poughkeepsie
Starrett Co., L. S., Athol, Mass.

GAGES, Plug and Ring
Brown & Sharpe Mfg. Co., Providence



CP "ONE MAN" YOKE RIVETERS SAVE TIME, LABOR AND MONEY FOR GENERAL MOTORS TRUCK CO.

THE General Motors Truck Company, Pontiac, Michigan, wanted to do their truck-frame riveting on a moving conveyor. Ordinarily this work is done while the frame is stationary, one man using a pneumatic hand hammer and a second man with a "bucking-up" bar. But such a method is practically impossible while the frame is in motion on the conveyor.

Chicago Pneumatic engineers recommended CP-60 Yoke Riveters (shown in the illustrations) and eight were installed. The vertical movement and counterbalance is provided by Pedwyn Safety Balancers (a CP accessory) while forward movement along the conveyor is accomplished by an overhead rail.

This method turns out three times as many frames, and the riveting, varying from $\frac{3}{8}$" to $\frac{1}{2}$", is of uniformly high quality. The first cost of the complete installation was about half that of the equipment previously used. Instead of two men synchronizing their operations, one man handles each machine—labor cost reduced one-half.

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Barber-Colman Co., Rockford, Ill.
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Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland
Newark Gear Cutting Machine Co., N. J.
Producto Machine Co., Bridgeport
Schuchardt & Schutte (Geo. Scherr Co., N. Y.
Waltham (Mass.) Machine Works
Whiton Mch. Co., D. E., New London, Conn.

GEAR Tempering Machinery
Gleason Works, Rochester, N. Y.

GEAR Testing Machinery
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Ferner Co., R. Y., Washington
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland
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Dodge Mfg. Corp., Mishawaka, Ind.
General Electric Co., Schenectady
Hartford (Conn.) Special Machy. Co.
Link-Belt Co., Chicago
Philadelphia (Pa.) Gear Works
Sier-Bath Gear Co. N. Y.

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Adams Co., Dubuque, Iowa
Atlantic Gear Works, Brooklyn
Bilgram Machine Works, Phila.
Boston Gear Works Sales Co., Quincy, Mass.
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Worm & Gear Co.
Diefendorf Gear Corp., Syracuse
Earle Gear & Mch. Co., Philadelphia
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Gears & Forgings, Inc., Cleveland
Gleason Works, Rochester, N. Y.
Grant Gear Works, Boston
Hartford (Conn.) Special Machy. Co.
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia (Pa.) Gear Works
Sier-Bath Gear Co. N. Y.
Simonds Mfg. Co., Pittsburgh

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Grant Gear Works, Boston
Hartford (Conn.) Special Machy. Co.
Philadelphia (Pa.) Gear Wks.

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Cleveland (O.) Worm & Gear Co.
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Mach. Co., Phila.
Foote Bros. Gear & Mach. Co., Chicago
Gears & Forgings, Inc., Cleveland
Grant Gear Works, Inc., Boston
Hartford (Conn.) Special Machy. Co
Morrison Mach. Co., Paterson, N. J.
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia (Pa.) Gear Works

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Oxweld Acetylene Co., Long Island City

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General Electric Co., Schenectady
Reliance Elect. & Eng. Co., Cleveland

GENERATORS, Electroplating
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Corning Glass Works, Corning, N. Y.

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(See Oil & Grease Cups)

GREASE Guns
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Greenfield (Mass.) Tap & Die Corp.

GRINDING Machines, Ball Bearing Race
(See Grinding Machines, Radial)

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Haskins Co., R. G., Chicago
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Norton Co., Worcester, Mass.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

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Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland

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Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester,
Van Norman Mach. Tool Co., Springfield, Mass.

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Barnes Co., W. F. & John, Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
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Greenfield (Mass.) Tap & Die Corp.
Heald Mach. Co., Worcester, Mass.
Norton Co., Worcester, Mass.
Oesterlein Mach. Co., Cincinnati
Sellers & Co., Wm., Philadelphia
Taylor & Fenn Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

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Micro Machine Co., Bettendorf, Ia.
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Van Norman Mach. Tool Co., Springfield, Mass.

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Bignall & Keeler Mach. Wks., Edwardsville, Ill.
Blanchard Mach. Co., Cambridge, Mass.
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Oliver Instrument Co., Adrian, Mich.
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Graham Mfg. Co., Providence
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Diamond Mach. Co., Providence
Marschke Mfg. Co., Towson, Md.
Norton Co., Worcester, Mass.
Walker Co., O. S., Worcester, Mass.

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Ferner Co., R. Y., Washington

GRINDING Machines, Gear
Lees-Bradner Co., Cleveland

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Schuchardt & Schutte (Geo. Scherr Co.), New York

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Cincinnati Grinders, Cincinnati
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Graham Mfg. Co., Providence

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Hanson-Van Winkle-Munning Co., Matawan, N. J.
Heald Mach. Co., Worcester, Mass.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Hartford
Walker Co., O. S., Worcester, Mass.

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Fitchburg (Mass.) Grinding Mach. Co.

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Gallmeyer & Livingston Co., Grand Rapids, Mich.
Greenfield (Mass.) Tap & Die Corp.
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Norton Co., Worcester, Mass.
Vitrified Wheel Co., Westfield, Mass.

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Chicago Pneumatic Tool Co., N.Y.C.

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High Speed Hammer Co., Rochester,

HAMMERS, Soft Metal
Producto Machine Co., Bridgeport

HAMMERS, Steam
Sellers & Co., Wm., Philadelphia

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Wilson-Maeulen Co., N. Y. C.

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Rockwell Co., Stanley P., Hartford.

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Newark Gear Cutting Machine Co., N. J.
Schuchardt & Schutte (Geo. Scherr Co.), New York

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Hanson-Whitney Machine Co., Hartford
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
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Harrington Co., Philadelphia
Union Twist Drill Co., Athol, Mass.
Wright Mfg. Co., Bridgeport, Conn.

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Harrington Co., Philadelphia

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Canton (O.) Fdry. & Machine Co.
General Electric Co., Schenectady
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Chicago Pneumatic Tool Co., N.Y.C.

HOISTS, Portable
Canton (O.) Fdry. & Machine Co.

HOLDERS-On, Pneumatic
Chicago Pneumatic Tool Co., N.Y.C.

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Lowe, Henry A., Cleveland
Standard Gage Co., Inc., Poughkeepsie

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Starrett Co., L. S., Athol, Mass.
Veeder-Root, Hartford

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Armstrong Bros. Tool Co., Chicago

JIG Bushings
Acme Industrial Co., Chicago

JIGS & Fixtures
(See Contract Work)

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Gray & Prior Mach. Co., Hartford

KETTLES, Soda
Gray & Prior Mach. Co., Hartford

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Whitney Mfg. Co., Hartford, Conn.

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Mitts & Merrill, Saginaw, Mich.

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American Swiss File & Tool Co., Elizabeth, N. J.

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MacDonald Bros. Eng'ring Laboratories, Boston

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General Electric Co., Schenectady

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Pratt & Whitney Co., Hartford
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Pratt & Whitney Co., Hartford
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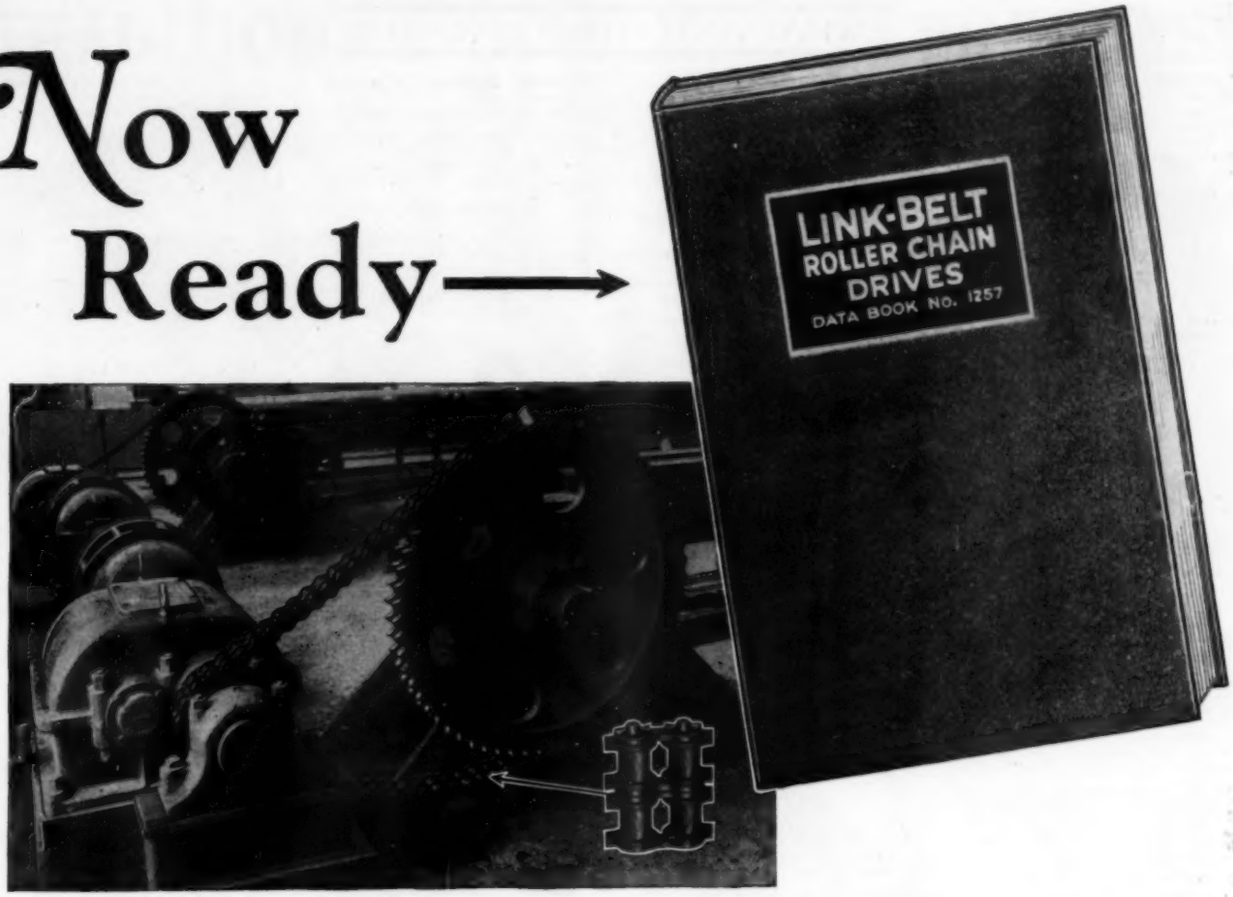

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LATHES, Chucking
(See Lathes, Horizontal & Vertical Turret)

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Wolverine Tube Co., Detroit

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Nicholson & Co., W. H., Wilkes-Barre

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Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney Co., Hartford
Producto Machine Co., Bridgeport
Shields Machine Tool Co., N. Y. C.
Sundstrand Mach. Tool Co., Rockford, Ill.

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Pratt & Whitney Co., Hartford
Stark Tool Co., Waltham, Mass.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

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Kearney & Trecker Corp., Milwaukee, Wis.
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Producto Machine Co., Bridgeport
Sundstrand Mach. Tool Co., Rockford, Ill.

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Producto Machine Co., Bridgeport
Van Norman Mach. Tool Co., Springfield, Mass.

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Sellers & Co., Wm., Philadelphia

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Pratt & Whitney Co., Hartford
Producto Machine Co., Bridgeport
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

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Kearney & Trecker Corp., Milwaukee, Wis.
Oesterlein Mach. Co., Cincinnati
Sellers & Co., Wm., Philadelphia

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Cincinnati (O.) Milling Mach. Co.
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Kearney & Trecker, Milwaukee.
Oesterlein Mach. Co., Cincinnati
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Van Norman Mach. Tool Co., Springfield, Mass.

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Ohio Electric & Controller Co., Cleveland
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NUT Tappers
(See Bolt & Nut Machinery)

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National Acme Co., Cleveland

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Alemite Corp., Chicago
Bay State Stamping Co., Worcester
Gits Bros. Mfg. Co., Chicago
Tucker, W. W. & C. F., Hartford, Conn.

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OIL Stones
Norton Co., Worcester, Mass.

OILS
(See Lubricants)

PAINT
Du Pont de Nemours & Co., E. I., Wilmington
Spraco Inc., Boston

PAINTING Equipment
Spraco Inc., Boston

PARALLELS
Starrett Co., L. S., Athol, Mass.

PATTERN Shop Machinery
(See Woodworking Machinery)

PENCILS
American Pencil Co., Hoboken

PIPE Cutting and Threading Machines
Bignall & Keeler Mach. Wks. Edwardsville, Ill.
Landis Machine Co., Waynesboro, Pa.
Merrell Mfg. Co., Toledo
Murchey Mach. & Tool Co., Detroit

PIPE Fitters' Tools
Butterfield & Co., Derby Line, Vt.
Greenfield (Mass.) Tap & Die Corp.

PLANING Machines
American Tool Wks. Co., Cincinnati
Cincinnati (O.) Planer Co.
Cleveland (O.) Planer Co.
Gray Co., G. A., Cincinnati
Sellers & Co., Wm., Philadelphia

PLATING Equipment & Supplies
Hanson-Van Winkle-Munning Co., Matawan, N. J.

PNEUMATIC Tools
Buckeye Portable Tool Co., Dayton
Chicago Pneumatic Tool Co., N.Y.C.

POLISHING and Buffing Machines
Barnes Co., W. F. & John, Rockford, Ill.
Blanchard Mach. Co., Cambridge, Mass.
Blount Co., J. G., Everett, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Chicago Pneumatic Tool Co., N.Y.C.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Greenfield (Mass.) Tap & Die Corp.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Heald Machine Co., Worcester,
Mitchell Engrg. Co., Springfield, O.
New Britain-Gridley Mach. Co., New Britain, Conn.
Rowbottom Mach. Co., Waterbury, Conn.
Standard Elect. Tool Co., Cincinnati
Union Twist Drill Co., Athol, Mass.
Van Dorn Electric Tool Co., Cleveland
Van Norman Mach. Tool Co., Springfield, Mass.

POLISHING & Buffing Machs. Elect. Portable
Clark Electric Co., J. Jr., Louisville
Standard Elec. Tool Co., Cincinnati
White Dental Mfg. Co., S. S., New York, N. Y.

POLISHING Wheel Resurfacing Machines
Scovil, D. & H., Higganum, Conn.

POST Boxes
Standard Pressed Steel Co., Jenkintown, Pa.

PRESS Feeds
Littell Mach. Co., F. J., Chicago
V. & O. Press Co., Hudson, N. Y.

PRESSED Steel Parts
Standard Pressed Steel Co., Jenkintown, Pa.
Truscon Steel Co. (Hydraulic Pressed Steel Division) Cleveland

PRESSES, Arbor
Barnes Co., W. F. & John, Rockford, Ill.
Logansport (Ind.) Machine Co.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

PRESSES, Drop Forging
American Can Co., N. Y. C.
Bliss Co., E. W., Brooklyn, N. Y.
Niagara Machine & Tool Wks., Buffalo
Toledo (O.) Machine & Tool Co.

PRESSES, Foot and Hand
Adriance Mach. Wks., Inc., Brooklyn
Bliss Co., E. W., Brooklyn, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo
Taylor & Fenn Co., Hartford, Conn.

PRESSES, Forcing
American Can Co., N. Y. C.
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Eng. Wks., Chas. F., Chicago
Lucas Mach. Tool Co., Cleveland
Watson-Stillman Co., N. Y.

PRESSES, Hydraulic
American Can Co., N. Y. C.
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

PRESSES, Power
Adriance Mach. Wks., Brooklyn
American Can Co., N. Y. C.
Barnes Co., W. F. & John, Rockford, Ill.
Bliss Co., E. W., Brooklyn, N. Y.
Cincinnati (O.) Shaper Co.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Ferracute Machine Co., Bridgeton N. J.
Henry & Wright Mfg. Co., Hartford
Niagara Mach. & Tool Wks., Buffalo
Pels & Co., Henry, N. Y.
Rowbottom Mach. Co., Waterbury,
Toledo (O.) Machine & Tool Co.
V&O Press Co., Hudson, N. Y.

PRESSES, Screw
American Can Co., N. Y. C.
Barnes Co., W. F. & John, Rockford, Ill.
Bliss Co., E. W., Brooklyn, N. Y.

PROFILING Machines
Stark Tool Co., Waltham, Mass.

PULLEYS, Metal
American Pulley Co., Philadelphia

PULLEYS, Steel Split
Dodge Mfg. Corp., Mishawaka, Ind.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago

PUMPS, Hydraulic & Power
Buffalo (N. Y.) Forge Co.
Elmes Eng. Wks., Chas F., Chicago
LaPointe Mach. Tool Co., Hudson, Mass.
Watson-Stillman Co., N. Y.

PUMPS, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence
Fulflo Specialties Co., Blanchester, O.

PUMPS, Portable
National Acme Co., Cleveland, Ohio

PUNCHES, Center
Starrett Co., L. S., Athol, Mass.

TRADITION PROGRESS

"Here, Lad—

I was just reading where an automobile of 90 miles per hour maximum speed, driven at 65 miles per hour will outlast a 65 mile per hour car driven at 65.

I can easily understand that."

"Yes, Pop—

Even I can understand it because that's just the way with motors.

Instead of speed however, it's overload capacity that determines how long it will stand up.

That's why I like the 'Linc-Weld' motor—the all steel motor. One of its predominant characteristics is Greater Overload Capacity.

That guarantees better performance.

It's something we both can see, because it isn't theory.

It's as easy to understand as Einstein's statement that American girls are the prettiest. We can understand that much better than his latest theory."

THE LINCOLN ELECTRIC COMPANY
Department No. 3—12 CLEVELAND, OHIO

M-58

LINCOLN
"LINC-WELD" MOTORS

PUNCHES, Hand
Armstrong-Blum Mfg. Co., Chicago

PUNCHES, Power
Buffalo (N. Y.) Forge Co.
Ferracute Machine Co., Bridgeton, N. J.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wks., Buffalo
Pels & Co., Henry, N. Y.
Wiedemann Mach. Co., Philadelphia

PUNCHING and Shearing Machines
Buffalo (N. Y.) Forge Co.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Pels & Co., Henry, N. Y.
Wickes Bros., Saginaw, Mich.

PYROMETERS, Electric
Bristol Co., Waterbury, Conn.
Wilson-Maeulen Co., N. Y. C.

RACKS, Cut
Adams Co., Dubuque, Ia.
Boston Gear Works Sales Co., Quincy, Mass.
Grant Gear Works, Boston
Hartford (Conn.) Special Machy. Co.
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.

REAMER Holders
Landis Machine Co., Waynesboro, Pa.

REAMERS, Adjustable
Barber-Colman Co., Rockford, Ill.
Brubaker & Bros. Co., W. L., Millersburg, Pa.
Cleveland (O.) Twist Drill Co.
Davis Boring Tool Co., St. Louis
Gammons-Holman Co., Manchester, Conn.
Greenfield (Mass.) Tap & Die Corp.
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford.

REAMERS, Solid
Ampco Twist Drill Co., Jackson, Mich.
Barber-Colman Co., Rockford, Ill.
Brubaker & Bros. Co., W. L., Millersburg, Pa.
Butterfield & Co., Derby Line, Vt.
Cleveland (O.) Twist Drill Co.
Gammons-Holman Co., Manchester, Conn.
Greenfield (Mass.) Tap & Die Corp.
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford
Producto Machine Co., Bridgeport
Union Twist Drill Co., Athol, Mass.

REAMERS, Taper
Ampco Twist Drill Co., Jackson, Mich.
Barber-Colman Co., Rockford, Ill.
Gammons-Holman Co., Manchester, Conn.
Greenfield (Mass.) Tap & Die Corp.
Producto Machine Co., Bridgeport
Union Twist Drill Co., Athol, Mass.

REAMING Machines
Blanchard Mach. Co., Cambridge, Mass.

RECORDERS, Pressure
Bristol Co., Waterbury, Conn.

RECORDERS, Temperature
Bristol Co., Waterbury, Conn.

RHEOSTATS
Cutler-Hammer, Milwaukee
General Electric Co., Schenectady

RHEOSTATS, Electroplating
Hanson-Van Winkle-Munning Co.,

RIVET Making Machinery
National Machinery Co., Tiffin, O.

RIVETING Machines
Chicago Pneumatic Tool Co., N.Y.C.
Grant Mfg. & Machine Co., Bridgeport, Conn.
High Speed Hammer Co., Rochester.

RIVET Sets
American Swiss File & Tool Co., Elizabeth, N. J.
Chicago Pneumatic Tool Co., N.Y.C.

ROD Cutters
Tucker, W. W. & C. F., Hartford.

RODS, Copper, Brass & Bronze
American Brass Co., Waterbury, Conn.

RULES, Steel
Starrett Co., L. S., Athol, Mass.

RUST Preventatives
Oakite Products, N. Y.
Wayne Soap Co., Detroit

SAND Rammers, Pneumatic
Chicago Pneumatic Tool Co., N.Y.C.

SAWING Machines, Band
Armstrong-Blum Mfg. Co., Chicago

SAWING Machines, Metal
Earle Gear & Machine Co., Phila
Peerless Machine Co., Racine, Wis.
Racine (Wis.) Tool & Mach. Co.

SAWING Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Peerless Machine Co., Racine, Wis.
Racine (Wis.) Tool & Mach. Co.

SAWS, Band
Simonds Saw & Steel Co. Fitchburg, Mass.

SAWS, Circular Metal Cutting
Simonds Saw & Steel Co., Fitchburg

SAWS, Hack, Frames & Blades
American Saw & Mfg. Co., Springfield, Mass.
Armstrong-Blum Mfg. Co., Chicago
Racine (Wisc.) Tool & Mach. Co.
Simonds Saw & Steel Co., Fitchburg
Starrett Co., L. S., Athol, Mass.

SAWS, Hack, Machine
Simonds Saw & Steel Co. Fitchburg, Mass.

SAWS Inserted Tooth
Simonds Saw & Steel Co. Fitchburg, Mass.

SAWS, Metal Cutting
American Saw & Mfg. Co., Springfield, Mass.
Racine (Wis.) Tool & Machine Co.
Simonds Saw & Steel Co., Fitchburg

SAWS, Milling
Barber-Colman Co., Rockford, Ill.
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Simonds Saw & Steel Co. Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SAWS, Screw Slotting
Simonds Saw & Steel Co. Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SCALES
Olsen, Tinius Test. Mach. Co., Philadelphia
Starrett Co., L. S., Athol, Mass.

SCRAPING Attachments, Spot
Anderson Bros. Mfg. Co., Rockford, Ill.

SCRAPING Machines, Metal
Anderson Bros. Mfg. Co., Rockford, Ill.
Jarvis Co., Chas. L., Gilderaleeve, Conn.

SCREW Drivers, Automatic
Errington Mech. Laboratory, S. I. N. Y.

SCREW Driving Attachments
Cleveland (O.) Twist Drill Co.

SCREW-Machine Work
Eastern Mch. Screw Corp., New Haven
Morris Machine Tool Co., Cinn.
National Acme Co., Cleveland
New Britain-Gridley Mach. Co., New Britain, Conn.

SCREW Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Automatic Machine Co.
Cone Auto. Mch. Co., Windsor, Vt
National Acme Co., Cleveland
New Britain-Gridley Mach. Co., New Britain, Conn.

SCREW Machines, Plain or Hand
Acme Machine Tool Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Automatic Machine Co.
Greenfield (Mass.) Tap & Die Corp.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford
Warner & Swasey Co., Cleveland

SCREW Plates
Bay State Tap & Die Co., Mansfield, Mass.
Brubaker & Bros. Co., W. L., Millersburg, Pa.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, O.
Greenfield (Mass.) Tap & Die Corp.

SCREWS, Cap and Set
Allen Mfg. Co., Hartford
Bristol Co., Waterbury, Conn.
Danly Machine Specialties, Inc., Chicago
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Machine
Allen Mfg. Co., Hartford
Bristol Co., Waterbury, Conn.
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland

SCREWS, Safety
(See Screws, Cap & Set)
Strong, Carlisle & Hammond Co., Cleveland

SEAMLESS Steel Tubing
(See Tubing, Seamless Steel)

SECOND-HAND Machinery
(See Searchlight Section)
American Tool Works Co., Cinn.
Botwinik Bros., New Haven
Brownell Machy. Co., Providence
Delta Equipment Co., Philadelphia
Emerman & Co., L. E., Chicago
Essley Mchy. Co., Chicago
General Mchy. Corp., Boston
Hill, Clarke & Co., Chicago
Hyman & Sons, J., Phila.
Miles Machy. Co., Saginaw
Sidney, O.
Morey & Co., N. Y.
Osborne & Sexton Mchy. Co., Columbus
Reed-Prentice Corp., Worcester
simmons Mach. Tool Corp., Albany
Strong, Carlisle & Hammond Co., Cleveland

SEPARATORS, Centrifugal
National Acme Co., Cleveland

SEPARATORS, Oil & Waste
Barrett Leon J., Worcester, Mass.

SHAFTING
Bliss & Laughlin, Harvey, Ill.
Strand & Co., N. A., Chicago

SHAFTS, Flexible
Haskins Co., R. G., Chicago
Strand & Co., N. A., Chicago
White Dental Mfg. Co., S. S., New York, N. Y.

SHAFTS, Splined
Adams Co., Dubuque, Iowa

SHAPERS
American Tool Wks. Co., Cincinnati
Cincinnati (O.) Shaper Co.
Hanson-Whitney Machine Co., Hartford
Hendey Machine Co., Torrington.
Potter & Johnston Mach. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford
Smith & Mills Co., Cincinnati
Springfield (O.) Machine Tool Co.

SHEAR Blades
Simonds Saw & Steel Co. Fitchburg, Mass.

SHEARS, Hand
Tucker, W. W. & C. F., Hartford.

SHEARS, Power
Adriance Mach Wks., Brooklyn
Buffalo (N. Y.) Forge Co.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Mitts & Merrill, Saginaw, Mich.
Niagara Mch. & Tool Wks., Buffalo
Pels & Co., Henry, N. Y.
Toledo (O.) Machine & Tool Co.

SHEET Metal Working Machinery
Adriance Mach Wks., Brooklyn
Bliss Co., E. W., Brooklyn, N. Y.
Cincinnati (O.) Shaper Co.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mch. & Tool Wks., Buffalo
Toledo (O.) Machine & Tool Co.

SHEETS, Copper, Brass & Nickel Silver
American Brass Co., Waterbury,

SLOTTING Machines
Sellers & Co., Wm., Philadelphia

SPECIAL Machinery
(See Contract Work)

SPECIAL Machinery & Tools
(See Contract Work)

SPEED Reducers
Adams Co., Dubuque, Ia.
Boston Gear Works, Sales Co., Quincy, Mass.
Cleveland (O.) Worm & Gear Co.
Foote Bros. Gear & Mach. Co.
Gears & Forgings, Inc., Cleveland
Grant Gear Works, Boston
Hartford Special Machinery Co., Hartford
Jones Fdry. & Machine Co., W. A Chicago
Link-Belt Co., Chicago
Morrison Mach. Co., Paterson, N. J.
Philadelphia (Pa.) Gear Wks.

SPINDLES
Ex-Cell-O Aircraft Tool Corp., Detroit

SPRINGS
Wickwire-Spencer Steel Corp., N.Y.C.

SPRING Winders
Hjorth Lathe & Tool Co., Boston

SPROCKETS and Chains
Bilgram Mach. Wks., Philadelphia
Boston Gear Works, Sales Co Quincy, Mass.
Cullman Wheel Co., Chicago
Grant Gear Wks., Boston
Jones Fdry. & Machine Co., W. A Chicago
Link-Belt Co., Chicago
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia (Pa.) Gear Works
Sier-Bath Gear Co., N. Y.
Whitney Mfg. Co., Hartford, Conn.

SQUARES
Starrett Co., L. S., Athol, Mass.

STAMPINGS, Metal
American Pulley Co., Philadelphia
Bay State Stamping Co., Worcester
Detroit (Mich.) Stamping Co.
Parish Pressed Steel Co., Reading.

STAMPS, Steel
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Noble & Westbrook Mfg. Co., Hartford
Schwerdtle Stamp Co., Bridgeport.

STANDS, Portable
(See Furniture, Machine Shop)

STEEL
Bliss & Laughlin, Harvey, Ill.

STEEL, BAR
Timken Roller Bearing Co., Canton, O.

STEEL, Cold Drawn
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL, Crucible
Columbia Tool Steel Co., Chicago Heights, Ill.
Simonds Saw & Steel Co. Fitchburg, Mass.

STEEL, Electric Furnace
Timken Roller Bearing Co., Canton, O.

STEEL, Sheet
Hawkridge Bros. Co., Boston
Simonds Saw & Steel Co. Fitchburg, Mass.

STEELS, Alloy, Carbon and High Speed
Columbia Tool Steel Co., Chicago Heights, Ill.
Hawkridge Bros. Co., Boston
Illinois Steel Co., Chicago
Simonds Saw & Steel Co. Fitchburg, Mass.
Timken Roller Bearing Co., Canton, O.
Truscon Steel Co. (Hydraulic Pressed Steel Division) Cleveland
Vanadium-Alloys Steel Co., Latrobe, Pa.

STOOLS, Jap
(See Furniture, Machine Shop)

STRAIGHTENING Machinery
Springfield (O.) Mch. Tool Co.

STUD Setters, Self Opening
Errington Mech. Laboratory, S. I. N. Y.

SUBPRESSES and Dies
Danly Mach. Spec., Inc., Chicago
U. S. Tool Co., Ampere, N. J.
Waltham (Mass.) Mach. Wks.

SWAGING Machines
Etna Machine Co., Toledo, O.
Torrington Co., Torrington, Conn.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TALC & Soapstone
Cohutta Talc Co., Dalton, Ga.

TANKS, Electroplating
Hanson-Van Winkle-Munning Co., Matawan, N. J.

TAP Extensions
Allen Mfg. Co., Hartford

TAP Extractors, Broken
Walton Co., Hartford, Conn.

TAP Holders
Errington Mech. Laboratory, S. I. N. Y.
Greenfield (Mass.) Tap & Die Corp.
Jarvis Co., Chas. L., Gilderaleeve, Conn.

TAPES, Measuring
Starrett Co., L. S., Athol, Mass.

TAPPING Machines and Attachments
Acme Machinery Co., Cleveland
American Tool Wks. Co., Cincinnati
Baker Bros., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Barnes Drill Co., Inc., Rockford, Ill.
Bradford Machine Co., Cincinnati
Cincinnati (O.) Bickford Tool Co
Errington Mech. Laboratory, S. I. N. Y.
Geometric Tool Co., New Haven,
Jarvis Co., Charles L., Gilderaleeve Conn.
Mitchell Engineering Co., Springfield, O.
Moline (Ill.) Tool Co.
Murchey Mach. & Tool Co., Detroit
National Machinery Co., Tiffin, O.
Superior Mach. Tool Co., Kokomo, Ind.

TAPS and Dies
Bay State Tap & Die Co., Mansfield, Mass.
Brubaker & Bros. Co., W. L., Millersburg, Pa.
Butterfield & Co., Derby Line, Vt
Card Mfg. Co., S. W., Mansfield.
Greenfield (Mass.) Tap & Die Corp.
Hanson-Whitney Machine Co., Hartford
Landis Machine Co., Waynesboro Pa.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford

TAPS, Collapsing
Geometric Tool Co., New Haven,
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland

TAPS, Ground
Hanson-Whitney Mach. Co., Hartford